

2005-2006

*Research for **your** health*

*La recherche au service
de **votre** santé*

Your Health Research
Dollars at Work

La recherche en santé,
ça rapporte

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Also available on the Web in PDF and HTML formats
© Her Majesty the Queen in Right of Canada (2006)
Cat. No. MR2-5/2006E-PDF
ISBN 0-662-44022-6

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Aussi affiché sur le Web en formats PDF et HTML
© Sa Majesté la Reine du chef du Canada (2006)
N^o de cat. MR2-5/2006F-PDF
ISBN 0-662-72484-4



In the past year, CIHR embarked on a significant and comprehensive evaluation of our first five years. The Review was conducted by a prestigious International Review Panel comprised of 27 outstanding research leaders from five countries. This evaluation was an important milestone in the evolution of CIHR.

One of the key messages to come out of the Review concerned the tremendous opportunities available to Canada to excel at health research. "Few places in the world have the quality of health researcher, the universal healthcare system, the university structure and the mandate to put together a program such as that being developed by the CIHR," the Panel stated.

By reading this collection of research highlights, *Your Health Research Dollars at Work 2005-2006*, I hope you will agree that CIHR's efforts are already making a difference to Canadians. I can point to numerous examples.

Researchers from the University of Saskatchewan have created a possible new vaccine for Hepatitis C. A team at the Providence Health Care Centre in Vancouver has developed new guidelines for assessing chest pains that will reduce emergency room overcrowding. Neuromed Inc., a young company also from Vancouver, this year signed a US\$475-million licensing deal with Merck for a new pain relief therapy. This deal, largest in the history of the Canadian biotechnology industry, was the result of funding over the past six years from CIHR to Dr. Terry Snutch, a professor at the University of British Columbia. Research organized by CIHR along with the provinces and territories helped deliver the evidence required for wait time benchmarks in three priority areas (cancer, joint replacement and sight restoration). This was a historic first for our healthcare system. These are just a few examples of the high-quality and high-impact work being supported by CIHR.

Health research helps address pressing health and scientific and social challenges, everything from pandemic preparedness to the demands of an aging society. It plays an integral role in ensuring the success of national strategies to address cancer, mental illness and heart disease. It is essential to support a high-quality, evidence-based, sustainable healthcare system for Canadians. It is driving the development of new products and services and attracting new investment.

I invite you to read further to find out how the Government of Canada, through CIHR, is contributing to a healthy, productive Canada.

Dr. Alan Bernstein, O.C., FRSC
President
Canadian Institutes of Health Research

Atlantic Canada at a Glance

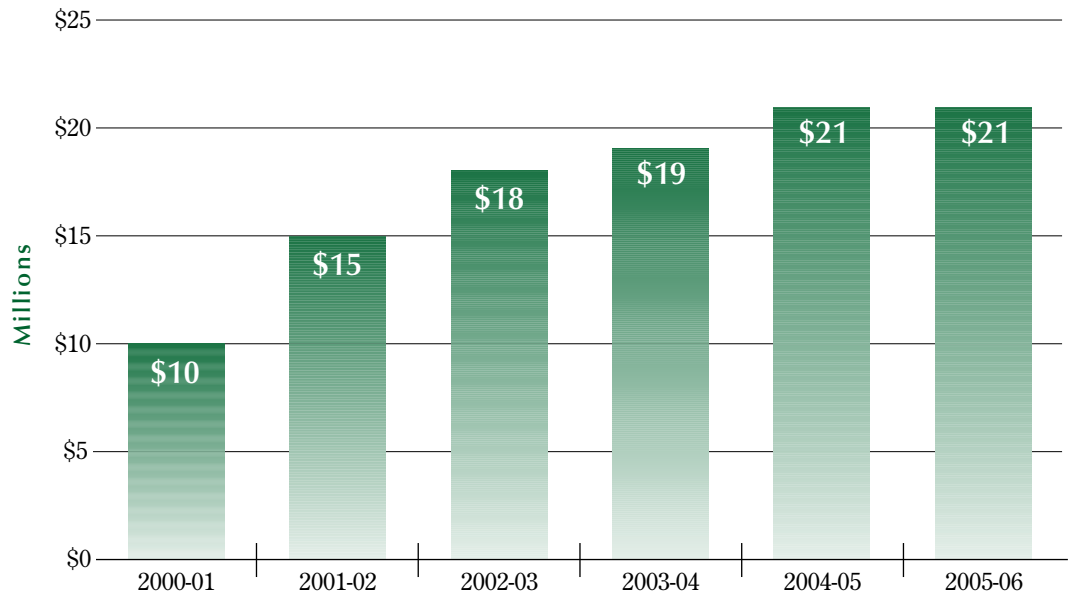
Some of Canada's most innovative and relevant health research happens in the provinces of New Brunswick, Nova Scotia, Prince Edward Island and Newfoundland and Labrador. In 2005-06, CIHR awarded approximately \$21 million to health research in Atlantic Canada, an increase of more than 110% from 2000-01. This funding supports more than 320 projects by principal investigators in 13 funded institutions.

About CIHR

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The Canadian Institutes of Health Research (CIHR) Supports Health Research in New Brunswick, Newfoundland and Labrador, Nova Scotia and Prince Edward Island

CIHR Investment in Atlantic Canada



Includes Clinical Research Centres and Networks of Centres of Excellence

Funding Excellence CIHR-Funded Health Research in Atlantic Canada

Universities in Atlantic Canada are known for their expertise and research achievements in a variety of areas. Here are some examples:

What Makes a Health Emergency?

Dr. Marilyn Hodgins, University of New Brunswick, Fredericton

According to a CIHR-supported study led by Dr. Marilyn Hodgins of the University of New Brunswick, patients in the province do not automatically head to the emergency room when they have a non-life-threatening illness. The survey of close to 2,000 New Brunswickers found that 74% tried to treat themselves first. Why do they go to the emergency department at all? Respondents cited fear that the condition might get worse; advice from others; and the lack of other options for dealing with the problem. Information such as this about New Brunswickers' use of healthcare services will help develop cost-effective and quality services that respond to people's healthcare needs.

Building Capacity for Commercialization

University of Prince Edward Island

CIHR funding is helping the University of Prince Edward Island increase its capacity to identify and commercialize promising research discoveries. In the past year, the university has received funding as part of CIHR's Commercialization Management Grants program, funding that will allow UPEI to increase staffing in its technology transfer office.

Working Towards a New Antibiotic

Dr. David Byers, Dalhousie University, Halifax

Dr. David Byers of the IWK Health Centre, Dalhousie University in Halifax received CIHR commercialization funding to create a novel antibiotic to treat conditions such as pneumonia, gastrointestinal disease and meningitis. To do it, he's focusing on interfering with one of the key enzymes needed by bacteria to create endotoxin, which is found in the outer membrane of certain types of bacteria. Using computer modelling, Dr. Byers has already designed and synthesized a molecule that can inhibit a key player in endotoxin synthesis. Funding to develop a proof of principle is an important step to help commercialize this work into a pre-clinical drug candidate.

A New Approach for Studying Asthma

Dr. Geoffrey Maksym, Dalhousie University, Halifax

CIHR-funded researcher Dr. Geoffrey Maksym of Dalhousie University is pursuing a new approach to the study of asthma. Most research in this area focuses on the immune response in asthma. But Dr. Maksym, a biomedical engineer, is studying how and why the smooth muscle that surrounds the airways muscles contracts, causing shortness of breath. This is accomplished, down to the level of an individual cell, through an innovative method of seeding cell cultures with tiny ferromagnetic beads to which the cells bind and which can be magnetically manipulated to move. When a person inhales, especially in response to an asthma attack, these smooth muscle cells pull. The beads can be used to understand how repeated pulling leads to stronger cells and worsening asthma. Research, which is ongoing, suggests that the use of long-acting bronchodilators with cortical steroids by asthma sufferers is a good thing, since it allows the muscles time to relax and possibly even reverses changes in the airway smooth muscle.

New Risk Factor Discovered for Diabetes

Dr. Guang Sun, Memorial University of Newfoundland, St. John's

CIHR-supported researcher Dr. Guang Sun has discovered a new risk factor for type 2 diabetes. In a study of blood samples from more than 1,000 human volunteers in Newfoundland and Labrador, Dr. Sun determined that an increase in serum calcium levels causes an increase in insulin resistance, contributing to the development of type 2 diabetes. An increase in serum calcium was also correlated with a decrease in beta cell (the cells that produce insulin) function. This research not only adds to the known list of risk factors for the disease, but, because the study subjects were not diabetic, it reveals a molecular change that occurs before clinical diagnosis is possible.

The Power of Volunteers – Atlantic Canada Researchers Helping to Build CIHR

CIHR volunteers, drawn from Canada's research community, form the backbone of the organization. They ensure that only the best proposals receive funding, help set priorities and ensure CIHR meets its mandate.

Dr. Daryl Pullman, CIHR Standing Committee on Ethics

Dr. Pullman is Associate Professor of Medical Ethics in the Faculty of Medicine at Memorial University of Newfoundland. His current research interests include research ethics, ethics and aging and issues related to genetic research and therapy. He has a continuing philosophical interest in the concept of human dignity and its foundational role in moral epistemology. His wide-ranging expertise enables him to make a significant contribution to CIHR's research on ethics.

Dr. Janice Keefe, CIHR's Institute of Aging Advisory Board

Dr. Keefe is currently an Associate Professor in the Department of Family Studies and Gerontology and a Canada Research Chair in Aging and Caregiving Policy at Mount St. Vincent University in Halifax. Dr. Keefe's research areas include informal caregiving, specifically work and elder care, financial compensation and assessment, human resource issues, rural aging and continuing care policy. As a member of the Institute's Advisory Board, Dr. Keefe helps to ensure that aging research funded by CIHR responds to real needs.

Dr. Judee Onyskiw, CIHR Oversight of Grants and Awards Committee

Dr. Judee Onyskiw is an Associate Professor at the University of New Brunswick. An estimated one-to-two million children in Canada witness violence at home. Dr. Onyskiw is examining how children cope in these situations and the long-term effects that witnessing violence have on their health and development. The goal of her research is to make the invisible victims of violence more visible. Through her membership on the CIHR Oversight of Grants and Awards Committee, Dr. Onyskiw helps advise the CIHR Governing Council about the outcomes of CIHR's competitions for research funding as well as monitor performance of CIHR's peer review process.

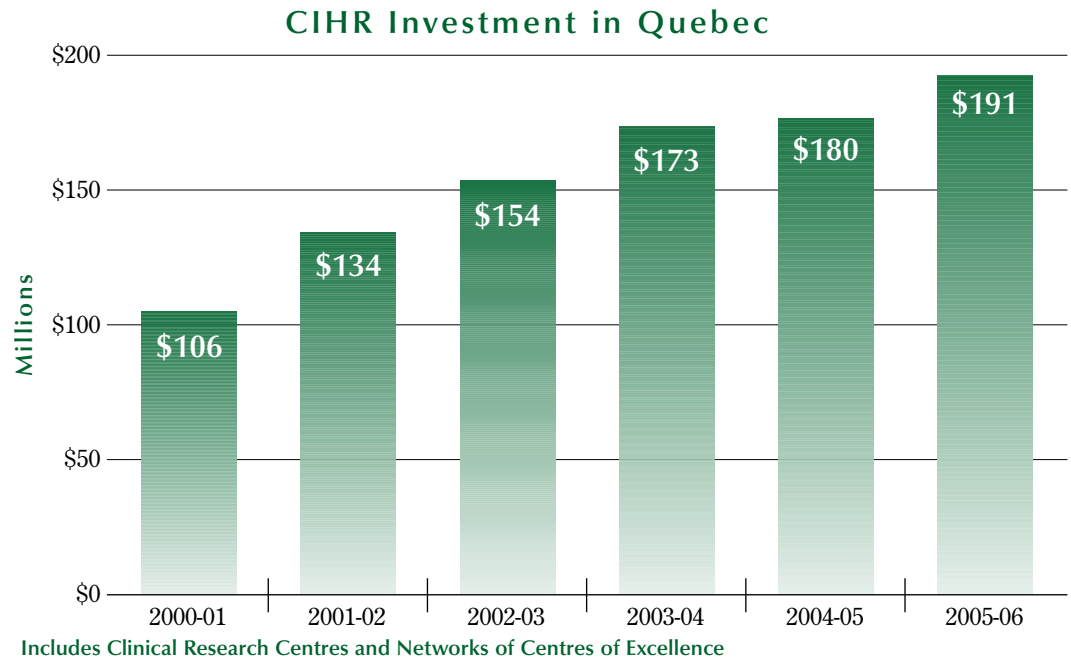
Quebec at a Glance

Health researchers in Quebec universities and hospitals are among the world's best. CIHR awarded approximately \$191 million for health research in Quebec in 2005-06, an increase of more than 80% from 2000-01. This funding supports more than 2,310 projects by principal investigators in 26 funded institutions.

About CIHR

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The Canadian Institutes of Health Research (CIHR) Supports Health Research in Quebec



Funding Excellence CIHR-Funded Health Research in Quebec

Universities in Quebec are known for their expertise and research achievements in a variety of areas. Here are some examples:

Building a Safer Blood Supply

Dr. Momar Ndao, McGill University, Montreal

Research by Dr. Momar Ndao of McGill University will help make the blood supply safer. Dr. Ndao's lab has developed and is testing an inexpensive yet comprehensive blood test that will test for all major parasitic diseases and determine if the blood is safe. Current parasite detection methods are expensive and complex and, as a result, blood is seldom tested for parasites.

Increasing the Power of Cancer Killer Cells

Dr. André Veillette, Institut de recherches cliniques de Montréal

So-called "natural killer" (NK) cells recognize and kill cancer cells. Health research teams have been trying for many years to find out how to increase NK-cell activity. Now, CIHR-supported researcher Dr. André Veillette, from the Institut de recherches cliniques de Montréal, has discovered that a protein called EAT-2 slows down the function of natural killer (NK) cells. If medications that suppress EAT-2 in humans can be developed, Dr. Veillette believes that NK cells will likely increase and work in conjunction with chemotherapy and radiotherapy to improve the effectiveness of cancer treatments.

The Power to Say No to Food

Dr. Louis Pérusse, Université Laval

Having difficulty saying no to food is not just a matter of poor self control; it may have genetic causes as well. CIHR-funded researcher Dr. Louis Pérusse at Université Laval has identified a gene linked to eating behaviours and obesity. A mutated version of the gene is related to a lowered ability to stop eating, as well as a susceptibility to hunger. Over a six-year period, people with the mutation gained more than twice as much body fat as people without the mutation.

Addressing the Burden of Aboriginal Suicide

Dr. Gustavo Turecki, McGill University, Montreal

Suicide rates in Aboriginal communities are almost ten times the national average. CIHR-supported researcher Dr. Gustavo Turecki of McGill University is leading a team to find out what, exactly, are the risk factors for suicide among Aboriginals. The team has begun conducting detailed, one-on-one interviews in communities across Nunavut with people who have survived a suicide attempt and with people who have had a family member or friend who has committed suicide. The team will also be talking to an equal number of people untouched by suicide. In the second part of the project, the team will interview only people who have attempted and survived suicide to learn more about what helped them overcome the threat of suicide and move on with life.

Testing the Effectiveness of Drugs to Prevent Blindness

Dr. Adriana Di Polo, Université de Montréal

In North America, glaucoma ranks as the second leading cause of blindness in Caucasians and is the leading cause of blindness among African Americans. Dr. Adriana Di Polo of Université de Montréal has received commercialization funding to study the use of a drug approved by the U.S. Food and Drug Administration for Alzheimer's disease. She wants to see if it can also prevent the death of retinal ganglion cells, which normally die with glaucoma. The outcome of this research is essential towards the potential development of this drug for the treatment and prevention of glaucoma.

The Power of Volunteers – Quebec Researchers Helping to Build CIHR

CIHR volunteers, drawn from Canada's research community, form the backbone of the organization. They ensure that only the best proposals receive funding, help set priorities and ensure CIHR meets its mandate.

Dr. Lucie Jeannotte, CIHR's Institute of Human Development, Child and Youth Health Advisory Board

Dr. Jeannotte is a full Professor in the Department of Medical Biology at Université Laval. Her research focuses on understanding the molecular mechanisms responsible for the development of the mammalian embryo, with a particular emphasis on the involvement of members of the Hox gene family. Her understanding of the processes of human development lends an important dimension to the work of the Institute.

Dr. André Cantin, Chair, CIHR's Institute of Circulatory and Respiratory Health Advisory Board

Dr. André Cantin is a Professor in the Department of Medicine, Respiratory Division, at the University of Sherbrooke. His research interests are in the areas of lung inflammation, oxidants and antioxidants in pulmonary fibrosis and cystic fibrosis. He is currently the Chair of the Medical and Scientific Advisory Board of the Canadian Cystic Fibrosis Foundation. As Chair of the Institute Advisory Board, he helps to set strategic priorities for health research and acts as a liaison to the wider respiratory and circulatory health research community.

Dr. Alain Lesage, CIHR's Institute of Neurosciences, Mental Health and Addiction Advisory Board

Dr. Lesage is Research Professor in the Department of Psychiatry at the Université de Montréal as well as a Quebec national health researcher (Fonds de la recherche en santé du Québec). His primary research focus is an epidemiological and evaluative look at the care and service needs of people with serious mental disorders. He also directs an evaluative support module for the development of psychiatric services at Hôpital Louis-H. Lafontaine. As a member of the Institute Advisory Board, he plays an important role in helping shape priorities for strategic initiatives such as mental health in the workplace.

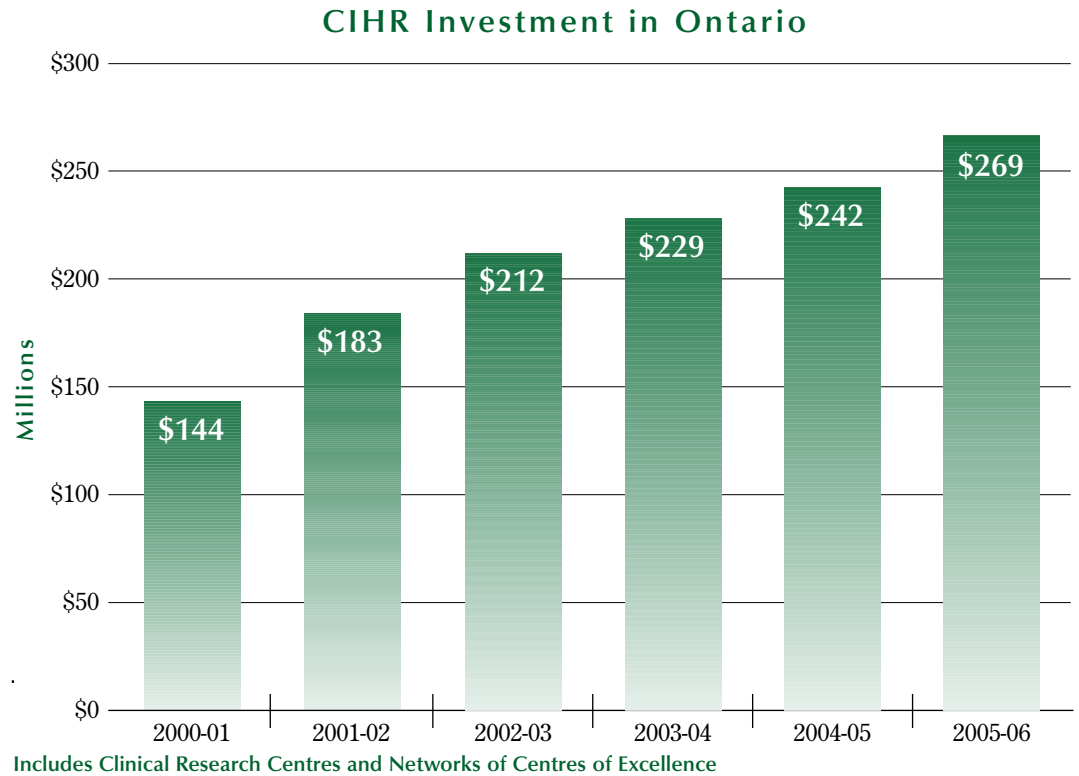
Ontario at a Glance

Ontario receives the largest share of CIHR funding – approximately \$269 million in 2005-06, an increase of more than 87% from 2000-01. This funding supports more than 2,940 projects by principal investigators in 37 funded institutions.

About CIHR

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The Canadian Institutes of Health Research (CIHR) Supports Health Research in Ontario



Funding Excellence CIHR-Funded Health Research in Ontario

Universities in Ontario are known for their expertise and research achievements in a variety of areas. Here are some examples:

The Ongoing Impact of the Walkerton Tragedy

Dr. Amit Garg, London Health Sciences Centre, The University of Western Ontario, London

Years after the outbreak of stomach infections and deaths caused by an *E. coli*-infected water supply in Walkerton, Ontario, the effects of the outbreak are still being felt. A study of almost 2,000 area residents found that 27% of those who had no symptoms at the time of the outbreak have since been diagnosed with hypertension. This figure climbs to 35% among people who had had severe symptoms of gastroenteritis. Roughly the same percentage of respondents also suffered from reduced kidney function. CIHR-supported researcher Dr. Amit Garg of the London Health Sciences Centre is the principal author of the study.

Of Microbes and Antibiotic Resistance

Dr. Gerard Wright, McMaster University, Hamilton

According to research by Dr. Gerard Wright of McMaster University, microbes found in soil have incredible resistance to antibiotic drugs. Dr. Wright collected 480 samples and found that each and every one was resistant to at least seven or eight antimicrobial agents. The study raises concern that such resistance mechanisms can be and are being transferred to existing bacterial pathogens affecting humans, creating superbugs resistant to new antibiotics.

Air Pollution and Childhood Asthma

Dr. Yue Chen, University of Ottawa, Ottawa

Air pollution sends poorer children to hospital with asthma more often than it does children from more affluent homes, according to research by CIHR-funded investigators, including Dr. Yue Chen of the University of Ottawa. The team was examining the effect of gaseous air pollutants such as carbon monoxide, sulphur dioxide, nitrogen dioxide and ozone. Exposure to nitrogen dioxide was most harmful to boys in low socio-economic groups, while sulphur dioxide was most harmful for girls from this group. The risk of asthma is higher for people from low socio-economic backgrounds.

Mapping Protein Interactions

Drs. Jack Greenblatt and Andrew Emili, University of Toronto

Dr. Jack Greenblatt of the University of Toronto has recorded the most comprehensive and reliable map of protein interactions in a living organism to date. His work, conducted with Dr. Andrew Emili, used sophisticated proteomic techniques to identify close to 4,000 proteins and 550 protein complexes involved in 7,123 protein-protein interactions in yeast cells. Disease results when these complexes and interactions go awry. The structure of proteins and their interactions in yeast cells are virtually identical to those in humans.

Technology Transfer Partnerships Accelerating Commercialization

Guelph, Waterloo, McMaster, Western Ontario Universities

A partnership among the technology transfer offices of McMaster University, University of Waterloo, University of Guelph and The University of Western Ontario is receiving funding from the Tri-Council Intellectual Property Management Program to help commercialize the results of research conducted at their universities. Under the partnership, the four universities will pool their technology transfer expertise, building horizontal teams on life sciences and physical sciences as well as groups in patent administration and industrial interaction. Potential private sector partners looking for new and innovative technologies will be able to tap into the intellectual property of four research-intensive universities using a single contact point. The University of Windsor and Wilfrid Laurier University will also be network members and, through this partnership, will be able to develop capacity in technology transfer.

The Power of Volunteers – Ontario Researchers Helping to Build CIHR

CIHR volunteers, drawn from Canada's research community, form the backbone of the organization. They ensure that only the best proposals receive funding, help set priorities and ensure CIHR meets its mandate.

Dr. Janet Rossant, CIHR's Institute of Genetics Advisory Board

Dr. Rossant is the Chief of Research at The Hospital for Sick Children and winner of the 2005 CIHR Michael Smith Prize in Health Research. Dr. Rossant is a world-leading developmental biologist who has made major contributions to our understanding of how an embryo develops, how genes control development and how embryonic and other stem cells arise. Her research interests centre on understanding the genetic control of normal and abnormal development in the early mouse embryo, work that has shed light on how congenital anomalies in the heart, blood vessels and placenta develop. Through her membership on the Institute Advisory Board, she is sharing the expertise acquired through a fruitful research career with the wider genetics community.

Dr. Mark Loeb, CIHR's Institute of Infection and Immunity Advisory Board

Dr. Loeb is an Associate Professor in the Department of Pathology and Molecular Medicine at McMaster University in Hamilton. Dr. Loeb's research interests include emerging infectious diseases, infections in seniors, respiratory infections and antimicrobial use and resistance. Dr. Loeb is Chair of the Pandemic Preparedness Research Task Group, part of CIHR-led pandemic preparedness research efforts.

Dr. Jeremy Grimshaw, CIHR's Institute of Health Services and Policy Research Advisory Board

Dr. Grimshaw is the Director of the Clinical Epidemiology Programme of the Ottawa Health Research Institute at the University of Ottawa. His research focuses on methods to promote the uptake of research findings by healthcare professionals. He was awarded the CIHR Knowledge Translation Award in 2004. He has been a member of the Institute's Advisory Board since 2004.

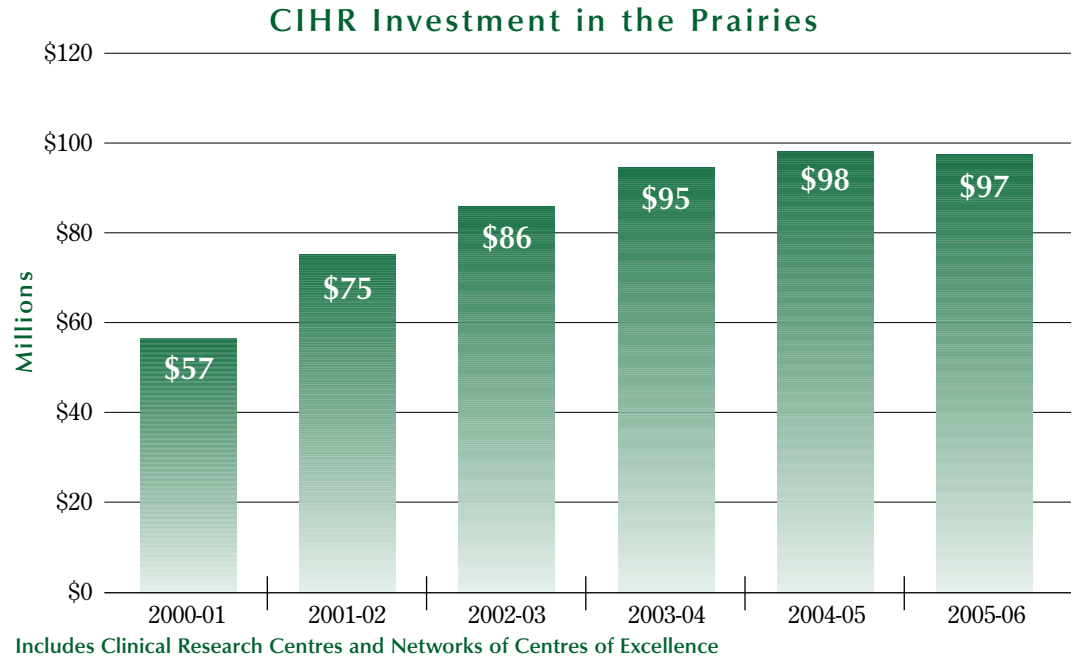
The Prairies at a Glance

Some of Canada's most exciting health research discoveries have their roots in Manitoba, Saskatchewan and Alberta. In 2005-06, CIHR awarded approximately \$97 million in funding for health research in Canada's three Prairie provinces, an increase of more than 70% from 2000-01. This funding supports more than 1,220 projects by principal investigators in seven funded institutions.

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The Canadian Institutes of Health Research (CIHR) Supports Health Research in Manitoba, Saskatchewan and Alberta



Funding Excellence CIHR-Funded Health Research in the Prairies

Universities in Manitoba, Saskatchewan and Alberta are known for their expertise and research achievements in a variety of areas. Here are some examples:

New Insights into Cancer Development

Dr. Sabine Mai, University of Manitoba, Winnipeg

It's been known for some time that the overproduction of a protein known as c-Myc plays a key role in the development of cancer. Work by CIHR-supported researcher Dr. Sabine Mai of the University of Manitoba has uncovered a new function for this protein, demonstrating that when c-Myc is present at a certain level, the ends of chromosomes become "sticky" and join together. When the cell divides, these conjoined chromosomes break apart, but at a different location. This cycle continues as these now altered chromosomes continue to attract new chromosomes and break in new locations, creating genetic instability and leading to uncontrolled growth of cells. New insights into how cancer develops are key to finding new ways to diagnose and treat cancers.

Where Addiction Lives

Dr. Xia Zhang, University of Saskatchewan, Saskatoon

An international team led by CIHR-supported researcher Dr. Xia Zhang at the University of Saskatchewan has discovered an enzyme known as PTEN that stimulates receptors for serotonin. This, in turn, increases brain activity in a way similar to the "rewards" produced by drug abuse. The team has been able to develop a peptide to block PTEN from reacting with the receptors. Their work, published in the prestigious journal *Science*, raises the possibility of developing future therapies to prevent addiction.

Helping to Understand What Genetic Variations Look Like

Drs. Steven Boyd and Benedikt Hallgrímsson, University of Calgary

CIHR-supported researchers Drs. Steven Boyd and Benedikt Hallgrímsson of the University of Calgary are working to close the gap between our genetic understanding of disease and what these genetic variations physically translate into, known as a phenotype. Currently, researchers studying the genetics of bone and joint diseases must manually identify important physical landmarks that define shape and, through this process, eventually understand how different genetic factors contribute to physical changes and abnormalities in bone growth. The researchers are developing a tool that combines image analysis software and a growing database of 3-D image scans of bones from mice bred for numerous different genetic variations. Researchers will be able to use the tool to quickly screen for significant variations between phenotypes, which can then be followed up for more detailed analysis. All of these can be easily linked back to a specific genetic variant, making the process even more efficient.

Understanding the Risk of Childhood Obesity

Dr. Paul Veugelers, University of Alberta

Packing a lunch, going to gym class twice a week and eating supper with your family at least three times per week seem to lower the risk of obesity among school-aged children. In addition, children in high-income neighbourhoods are half as likely as their peers living in low-income neighbourhoods to develop obesity. CIHR-funded researcher Dr. Paul Veugelers of the University of Alberta surveyed fifth grade students from Nova Scotia on dietary habits, activities and other risk factors for obesity. His findings will help officials plan more effective school-based health initiatives to reduce the threat of obesity for school-aged children, especially those in low-income neighbourhoods.

Rural Communities, Resiliency and Health

Dr. Judith Kulig, University of Lethbridge

Living in resource-reliant rural communities is good for your health, according to residents of two such communities in Alberta. Dr. Judith Kulig of the University of Lethbridge studied the two communities, together with a third, urban community, to determine what makes communities resilient and whether there is a link between resiliency and health status. Participants in the study perceived their rural communities as healthy and believed that living in their communities enhanced their health. Social interactions were seen as essential to health, although participants also expressed concerns about environmental health issues.

The Power of Volunteers – Prairie Researchers Helping to Build CIHR

CIHR volunteers, drawn from Canada's research community, form the backbone of the organization. They ensure that only the best proposals receive funding, help set priorities and ensure CIHR meets its mandate.

Dr. Liam J. Murphy, CIHR Oversight of Grants and Awards Committee

Dr. Murphy is currently Director of the Diabetes Research Group, Head of the Section of Endocrinology and Metabolism at the University of Manitoba and Consortium Head of Endocrinology and Metabolism at the province's two major teaching hospitals, St. Boniface Hospital and the Health Sciences Centre. Dr. Murphy has established an internationally competitive research program in the area of molecular endocrinology of the insulin-like growth factors. Through his membership on the Oversight of Grants and Awards Committee, Dr. Murphy helps advise the CIHR Governing Council about the outcomes of CIHR's competitions for research funding as well as monitor performance of CIHR's peer review process.

Dr. Janet Smylie, CIHR's Institute of Aboriginal Peoples' Health Advisory Board

Dr. Smylie is Director, Saskatchewan's Indigenous Peoples' Health Research Centre and an Associate Professor in the Department of Community Health & Epidemiology at the University of Saskatchewan. Her research interests include health indicators of relevance to Indigenous communities and knowledge translation and Indigenous knowledge. She is a member of the Métis Nation of Ontario. As a member of the Institute Advisory Board, she helps set strategic priorities for research and represents the Institute to the larger scientific community.

Dr. Joel Weiner, Chair, CIHR's Institute of Genetics Advisory Board

Dr. Weiner is a Professor in the Department of Biochemistry at the University of Alberta and Canada Research Chair in Membrane Biology. Membrane proteins play essential roles in defining the functionality of all biological membranes, and abnormalities in their function are becoming recognized as important factors in various disease states. In pathogenic bacteria, they also have importance as potential targets for new antimicrobial agents. Dr. Weiner is studying bacterial membrane proteins, with particular emphasis on *Escherichia coli* (*E. coli*) membrane-bound respiratory chain enzymes. As Chair of CIHR's Institute of Genetics Advisory Board, he takes part in setting strategic priorities for research and represents the Institute to the larger scientific community.

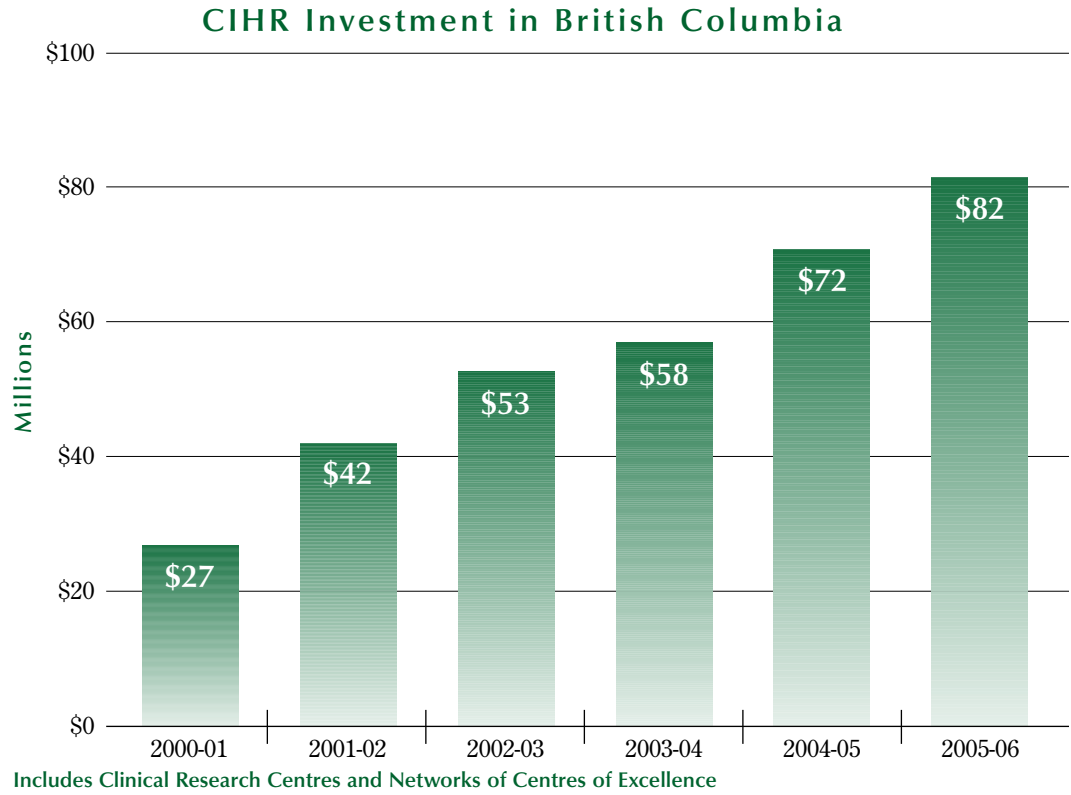
British Columbia at a Glance

CIHR awarded approximately \$82 million in funding for health research in British Columbia in 2005-06, an increase of more than 204% from 2000-01. This funding supports more than 930 projects by principal investigators in eight funded institutions.

About CIHR

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The Canadian Institutes of Health Research (CIHR) Supports Health Research in British Columbia



Funding Excellence CIHR-Funded Health Research in British Columbia

Universities in British Columbia are known for their expertise and research achievements in a variety of areas. Here are some examples:

Understanding Homeless Youth

Dr. Mikael Jansson, University of Victoria, Victoria

As part of a CIHR-funded survey, University of Victoria sociologist Mikael Jansson has been studying the homeless youth population in Victoria, B.C. The most common reason for living on the street is family instability, the survey found. Almost all participants reported earning money by selling drugs; most also use drugs on a weekly basis, with 75% reporting using marijuana, 45% drinking alcohol and 20% using crystal meth. Only 7% had a paying job and, while most wanted a job, lack of an address, a phone and work clothing stood in their way. The project also highlighted the inherent challenges of research involving hard-to-reach or hidden populations. Dr. Jansson and his team have followed many of the youth over the past five years, and hope to continue for another five years.

What Makes Pathogens Dangerous

Dr. Fiona Brinkman, Simon Fraser University, Burnaby

CIHR-supported researcher Dr. Fiona Brinkman of Simon Fraser University is working to understand how bacteria evolve and when they cross the line from harmless to pathogenic. Part of the answer lies in the concept of "genomic islands" – as bacteria evolve and mutate, they can acquire genetic

traits from other bacteria and bacterial “viruses”. Often, these traits make a bacterium more virulent. With CIHR funding, Dr. Brinkman is building improved computer software tools to analyze these islands and identify the genes causing virulence. Such research is vitally important to other researchers focused on building drugs and therapies to fight the pathogens.

Mapping Drug Usage in Canada

Dr. Steve Morgan, University of British Columbia, Vancouver

Prescription drugs are the fastest-growing category of healthcare spending in Canada. A recent study by CIHR-funded researcher Dr. Steve Morgan at the University of British Columbia gives, for the first time, an accurate picture of how drugs are being used across Canada. The Canadian Rx Atlas highlights differences in drug use in different parts of the country and breaks down the factors that drive drug spending. The Atlas will be useful to provincial and territorial health officials across Canada as they face the complex problem of how to control rising prescription drug costs.

Chronic Obstructive Pulmonary Disease – No Longer a Man’s Disease

Dr. Susan Kennedy, University of British Columbia, Vancouver

Chronic Obstructive Pulmonary Disease (COPD) is the fourth leading cause of death in North America and is rapidly increasing in women. A new interdisciplinary research program is studying the reasons why and building capacity for more research in this area. Led by Dr. Susan Kennedy, researchers will address physiological differences – women have larger airways which could result in more toxins being inhaled and deposited – as well as socio-economic and environmental factors that could explain why the disease is increasing so rapidly in women. As a first step, team members, all experts in the area of respiratory diseases, are also re-examining their earlier research to see if different conclusions can be drawn if gender is considered.

Commercializing Improved Prostate Cancer Diagnostics

Dr. Marianne Sadar, B.C. Cancer Research Centre, Vancouver

One in eight men is diagnosed with prostate cancer, making it the most frequently diagnosed cancer in men. However, current diagnosis methods are unable to determine which tumours will become life-threatening, exposing many men to unnecessary and potentially damaging radiation treatment or prostate cancer surgery. Dr. Marianne Sadar of the B.C. Cancer Research Centre in Vancouver received CIHR commercialization funding to evaluate and develop a custom microarray that analyzes the hormonal progression of prostate cancer. The tool would be able to distinguish between truly aggressive cancers and non-threatening situations – not only reducing unnecessary suffering but also relieving pressure on the healthcare system.

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Dr. Michael McDonald, CIHR Standing Committee on Ethics

Dr. McDonald is Maurice Young Chair of Applied Ethics at UBC. His current research centres on the ethics of research involving humans. He is also involved in two research projects on ethical issues in transplantation, one on ethnocultural attitudes towards organ donation and the other on living anonymous kidney donation. His expertise helps CIHR in considering ethical issues raised by health research.

Dr. Martha MacLeod, CIHR’s Institute of Health Services and Policy Research Advisory Board

Dr. MacLeod is an Associate Professor in the Nursing and Community Health Programs at the University of Northern British Columbia, Prince George, BC. She teaches in the areas of nursing management/ leadership, knowledge development, qualitative research and advanced community practice. Her research is on the nature of everyday experience and practice and how professional practice and expertise may be developed or hindered within healthcare organizations, particularly those in rural and remote settings. Her wide range of practical knowledge helps the Institute formulate research priorities that answer important questions about Canada’s healthcare system.

Dr. Cecilia Benoit, CIHR’s Institute of Population and Public Health Advisory Board

Dr. Benoit is a Professor in the Department of Sociology at the University of Victoria. Her research interests span a wide range of subjects, from the relationship between gender, work and health, to midwifery and maternity care, youth in transition to adulthood, health and occupational-based stigmas, injury prevention and community-based research. Current projects include a mixed-methods study of frontline service workers’ health status and access to health services; social factors affecting the health and well-being of street-involved youth; and social determinants of the health of new mothers.

The CIHR Institute

CIHR's Institute for Aboriginal Peoples' Health has a mission - to reduce the health disparities that affect the lives of so many Aboriginal Peoples in Canada. It is forging partnerships, based on research excellence, with researchers and communities that respect Aboriginal values and cultures, while engaging Aboriginal People to become health researchers themselves.

About CIHR

The Canadian Institutes of Health Research (CIHR) is the Government of Canada's agency for health research. CIHR's mission is to create new scientific knowledge and to catalyze its translation into improved health, more effective health services and products, and a strengthened Canadian healthcare system. Composed of 13 Institutes, CIHR provides leadership and support to more than 10,000 health researchers and trainees across Canada.

The Canadian Institutes of Health Research (CIHR) is the Government of Canada's agency for health research. Through CIHR, the Government of Canada invested approximately \$19.5 million in 2005-06 in Aboriginal health research across Canada.

The Facts

Life expectancy and the burden of disease for Aboriginal Canadians differs from other Canadians. From the data that are available we know the following:

- In 2000, First Nations males had a life expectancy of 68.9 years compared to 76.6 years for females. In comparison, non-Aboriginal Canadians' life expectancies in 2001 were longer by 8.1 years for males and 5.5 years for females.*
- The infant mortality rate among First Nations in 2000 was 6.4 deaths per 1,000 live births, compared to the Canadian infant mortality rate of 5.5.*
- The tuberculosis rate among First Nations people is 6.2 times higher than in the general population.*
- Diabetes is 2.7 times more prevalent among First Nations than in the general population.*
- First Nations peoples on reserves have reported rates of heart diseases 16% higher than the general population.*

Research Finding Solutions to Aboriginal Peoples' Health

- CIHR-funded researcher Dr. Paul Hackett of the University of Manitoba has applied historical research to learn more about the underlying causes of disease and mortality rates among First Nations people in Manitoba and to demonstrate how such information could help policy-makers develop better health services for First Nations people. He notes that past efforts by the health system to deal with diseases such as tuberculosis have created negative experiences passed down from one generation to the next and, as a result, may limit the effectiveness of current health initiatives.
- In an ongoing study of First Nations people's use of healthcare services, CIHR-supported researcher Dr. Patricia Martens of the University of Manitoba and Doreen Sanderson of the Assembly of Manitoba Chiefs found that, while First Nations people use hospitals and ambulances more than all other Manitobans, they do not seek as many consultations with healthcare specialists. Further research will shed light on whether the low consultation rate has anything to do with lack of access or referral biases.
- Metabolic syndrome is the term used to describe a broad range of conditions occurring together that all can lead to heart disease. The list includes obesity, especially abdominal obesity, high blood sugar, high blood pressure and cholesterol problems. In a study of Canadians of European origin living in Manitoba, Oji-Cree First Nations from northwestern Ontario and Manitoba and Inuit from the Keewatin region of Nunavut, CIHR-funded researcher Dr. Kue Young of the University of Manitoba found that metabolic syndrome varies substantially according to ethnic group. Compared with Canadians of European origin, First Nations had a worse metabolic profile, while Inuit had a better metabolic profile except for a high rate of abdominal obesity. Metabolic syndrome affects as many as 45% of First Nations women and as few as 8% of Inuit men.

* Health Canada (First Nations and Inuit Health Branch) 2000.

The Researchers... Dr. Caroline Tait – Addressing High-risk Problems for Canada’s Aboriginal Peoples

Existing treatment and support programs designed to prevent fetal alcohol spectrum disorder (FASD) are no match for the poverty and inadequate housing that contribute to the vulnerability and marginalization of a group of Indigenous women who are at risk of abusing alcohol while pregnant, according to Dr. Caroline Tait, a Métis medical anthropologist and Assistant Professor at the University of Saskatchewan. She is studying the root causes of FASD and her research has shown that overcrowding and the lack of safe and adequate housing both on and off reserve play a major role in increased mental distress and alcohol abuse.”

“The person goes through treatment,” says Dr. Tait. “They’re healthier, they’re eating better, they’ve been getting counseling. Then they head right back to the same conditions that reinforced their substance abuse.”

Dr. Tait says that researchers, policy-makers and indigenous community leaders need to work together in order to address overcrowding and the lack of safe and affordable housing on and off reserve. From there, efforts can be better made to resolve poverty, mental health problems, poor nutrition and low educational status among Canada’s Aboriginal people.

Dr. Tait can relate to poverty. She grew up poor in a small town in Saskatchewan, and did not have the opportunity to attend university until she was in her late 20s. Once there, however, she rapidly completed a series of degrees, winning significant awards along the way, including a Fulbright scholarship. In May 2004, Dr. Tait was hired by the Indigenous Peoples Health Research Centre (IPHRC), in a tenure-track position.

Now, as well as continuing her research on FASD prevention and mental health disparities among Canada’s Aboriginal peoples, Dr. Tait is focusing on building a strong research community in the area. She is an active member of the National Network for Aboriginal Mental Health Research, which was created in 2001 to build capacity for mental health research in Aboriginal communities. The network combines mentorship programs for students with a strong interdisciplinary approach to research. This approach brings together community representatives, researchers, mental health practitioners, public health experts, educators and front-line health and social service workers.

“We need interdisciplinary research,” says Dr. Tait. “We need to continue along that path. I think it’s really important to have that dialogue and networking opportunities.”

- As part of an ongoing study to examine the prevalence of, and risk factors for, complications of type 2 diabetes among Aboriginal Canadians, CIHR-funded researcher Dr. Anthony Hanley from the University of Toronto looked at the causes of peripheral arterial disease (PAD), which restricts blood circulation in arteries leading to the kidneys, stomach, arms, legs and feet. People with PAD often have fatty buildup in the arteries of the heart and brain which raises the risk of death from heart attack and stroke. Persons with type 2 diabetes are twice as likely to develop PAD. There have also been questions about the role of a genetic mutation known as MTHFR 677C>T. Research with Oji-Cree with type 2 diabetes and who have this particular mutation determined that, for the Oji-Cree, MTHFR 677C>T is a major risk factor for developing PAD. The research was conducted in partnership with the Sandy Lake First Nations Band.
- Dr. Chris Furgal, from Université Laval, in partnership with the Inuit Tapiriit Kanatami, is investigating the impact of environmental contaminants in the Canadian Arctic on human health. He has discovered that various organochlorines (OCs) and toxic metals are found in the traditional diets of Aboriginal peoples who live there. This can contribute to immune system, birth weight and childhood respiratory problems, among other impacts. In order to make any changes to these traditional diets, Dr. Furgal says that health researchers must be respectful of the social, cultural, spiritual, nutritional and economic beliefs of the members of the Arctic communities who consume the contaminated foods.

In the Pipeline... Addressing the Burden of Aboriginal Suicide

Suicide rates in Aboriginal communities are almost ten times the national average. CIHR-supported researcher Dr. Gustavo Turecki of McGill University in Montreal is leading a team to find out what, exactly, are the risk factors for suicide among Aborigines. The team has begun conducting detailed one-on-one interviews in communities across Nunavut with people who have survived a suicide attempt and with people who have had a family member or friend who has committed suicide. The team will also be talking to an equal number of people untouched by suicide.

The second part of the project, led by Dr. Rod McCormick, a Mohawk psychologist and professor at the University of British Columbia, will interview only people who have attempted and survived suicide. Interviews will take place in Aboriginal communities in British Columbia, Ontario, Quebec, Nova Scotia and Nunavut. The researchers want to learn more about what helped these people overcome the threat of suicide and move on with life. The project includes the following organizations as partners: Nunavut Tunngavik Inc.; Isaksimagit Inuusirmi Katujjiqatigiit (‘Embrace Life’ suicide prevention council, Nunavut); Office of the Chief Coroner of Nunavut Snuneymuxw First Nation (B.C.); and the Inter Tribal Health Authority (B.C.).



CIHR IRSC
2005-2006

Aging

The CIHR Institute

Canada's population is aging – by 2050, 20% of Canadians will be over 65. CIHR's Institute of Aging is helping older Canadians of today and tomorrow enjoy good health and quality of life by focusing on a wide range of conditions associated with aging.

About CIHR

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The Canadian Institutes of Health Research (CIHR) is the Government of Canada's agency for health research. Through CIHR, the Government of Canada invested more than \$63.6 million in 2005-06 in aging-related research across Canada.

The Facts

- By 2031, 23-25% of the population will be 65 and older, more than double their current proportion of 11% (based on 2005 estimates). By 2056, people 65 and over would represent 25-30% of the population.
- By 2056, an estimated one in ten Canadians would be 80 years or over, compared with about one in 30 in 2005.
- Life expectancy in 2003 hit a record high of 79.9 years – 82.4 for women and 77.4 for men.
- In 2003, 73% of seniors reported that their health was excellent, very good or good.
- Income and education can affect health. Healthy Canadians over the age of 50 with higher incomes and higher levels of education are less likely to see their health deteriorate over a two-year period, compared to those with similar health status but lower incomes or less education.

Research Finding Solutions for Healthy Aging

- Researchers at the Brain Research Centre at the University of British Columbia, working under the direction of Dr. Max Cynader, are investigating The Aging Brain. The team members, many of whom are funded by CIHR, have found that running and other forms of physical exercise can triple the number of new brain cells in aged animals. They have also found that animals fed a restricted diet of 25-40% less than their free-feeding counterparts are living 30-40% longer and their vulnerability to age-related neurodegenerative diseases is similarly delayed.
- Nine of 14 seniors (aged 62-90) who took tango lessons dramatically reduced their risk of a severe fall, compared to only three of the ten seniors who walked twice a week, in a study by CIHR-funded researcher Patricia McKinley from McGill University. All of the volunteers in the study had suffered a fall within the past year and had developed a fear of falling – one of the biggest factors inhibiting seniors' autonomy. Dancing led to better coordination and balance and to improvements in "working" memory – tasks such as reordering random letters and numbers in a logical sequence. The memory improvements were significant and lasted for weeks after the end of lessons; less significant improvements in the walking group didn't last past the end of the walking.
- The ability to measure frailty in older adults is useful both for healthcare policy and for clinical care. CIHR-funded researcher Dr. Kenneth Rockwood of Dalhousie University has devised the Clinical Frailty Scale to measure frailty, something that, to date, has proved elusive. The seven-category scale is easy to use in a clinical setting and is a good predictor of death or the need for entry into an institutional facility. The scale also permits clinicians to exercise flexibility in response to specific factors.
- Older adults can learn to multitask if given the time to do so, according to research by CIHR-funded investigator Allison Sekuler of McMaster University. Her research provides evidence that deterioration is not inevitable in the aging brain. She has also found that older adults do

just as well as young adults on visual, short-term memory tests – but use a different part of the brain to do so. And, when it comes to grasping the big picture, older adults' brains are quicker and better, suggesting that young people are better at focusing on finer detail, while older people see larger patterns more easily.

In the Pipeline... The Canadian Longitudinal Study on Aging

Canada's population is aging. But while life expectancy has increased, life without disability has not increased to the same extent. A growing number of older Canadians will face the combined effects of a decline in physical function, medical problems and the development of chronic diseases. Improving the health of older Canadians requires a better understanding of the processes of aging.

The Canadian Longitudinal Study on Aging (CLSA) is a large, national, long-term study that will follow 50,000 Canadians aged 40 and over for a period of at least 20 years. The study will collect information on the biological, medical, psychological, social and economic aspects of their lives to better understand how these factors have an impact on aging. The study will examine health patterns and trends and identify ways to reduce disability and suffering among aging Canadians.

The study builds upon previous efforts such as the Aging in Manitoba Longitudinal Study, the longest and most comprehensive study of aging in Canada to date, which has followed almost 9,000 older Manitobans over the 30-year study period.

The Researchers... Professor François Béland, Ph.D. – Facilitating Seniors' Access to Healthcare

After completing his doctoral studies, Professor François Béland's first job was to evaluate the first home care service policy in Quebec – three-quarters of the users of this service were seniors. Since then, he has focused his research on social gerontology, in particular access to health services, the health of elderly populations and methods of integrating health and social services for seniors.

In 1983, he entered the Health Administration department of the Université de Montréal's Faculty of Medicine as a researcher and is now a full Professor there. He is a researcher with the *Groupe de recherche interdisciplinaire en santé* (GRIS) at the Université de Montréal, Associate Professor with the Geriatric Services department of McGill University's Faculty of Medicine, and Co-director, with Dr. Howard Bergman, of SOLIDAGE, the Université de Montréal-McGill University research group on integrated services for older persons.

SOLIDAGE was created in 1999 as an Interdisciplinary Health Research Team, funded by CIHR to foster collaboration among researchers on integrated services for seniors. Based at the Lady Davis Institute for Medical Research, Jewish General Hospital, SOLIDAGE focuses on research on the integration of services and the frailty of the elderly, as well as their implications for health policies, funding, organization and management of services, and clinical practice.

SOLIDAGE was formed to conduct research in several areas. The conceptualization, implementation and evaluation of the system of integrated services for seniors (SIPA - *Système de services intégrés pour personnes âgées*) is one of SOLIDAGE's major accomplishments. In this evaluation, 1,230 frail elderly individuals were recruited for SIPA's experimental study in Montreal. The results revealed that SIPA had successfully replaced institutional services with community resources at no additional cost, without increasing the burden on loved ones, and maintaining, if not increasing, the quality of services.

SOLIDAGE works closely with the Canadian Initiative on Frailty and Aging and the Canadian Longitudinal Study on Aging.

"Collaboration allows us to pool the information available to help us implement effective health policies and ensure the best possible quality of life for elderly individuals across Canada," affirms Professor Béland.

Professor Béland plans to build on the support he has received for SOLIDAGE in order to continue his research and researcher training program and actualize the collaboration begun by SOLIDAGE and other research groups in Quebec, Canada and other countries over the past few years.



CIHR IRSC
2005-2006

Alzheimer's Disease

The CIHR Institute

Canada's population is aging – by 2050, 20% of Canadians will be over 65. CIHR's Institute of Aging is helping older Canadians of today and tomorrow enjoy good health and quality of life by focusing on a wide range of conditions associated with aging.

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The Canadian Institutes of Health Research (CIHR) is the Government of Canada's agency for health research. Through CIHR, the Government of Canada invested approximately \$18.7 million in 2005-06 in research on Alzheimer's disease across Canada.

The Facts

- Caring for people with Alzheimer's disease costs about \$5.5 billion each year in Canada.
- One in 20 Canadians over age 65 – and one-in-four over age 85 – is affected by Alzheimer's disease.
- Alzheimer's disease is the most common form of dementia, accounting for nearly two-thirds, or 64%, of all dementias.
- In 2005 there has been an estimated 94,270 new cases of dementia; by 2011 new cases of dementia are expected to reach 111,560/year.
- Twice as many women as men have dementia.
- More than a quarter of a million Canadians (280,000) over 65 have Alzheimer's disease. By 2031, more than 750,000 Canadians are expected to have Alzheimer's disease and related dementias.
- Half of Canadians know someone with Alzheimer's disease and one quarter of Canadians have someone in their family with the disease.

Research Finding Solutions to Alzheimer's Disease

- CIHR-supported University of Toronto researchers Drs. Peter St. George-Hyslop and JoAnne McLaurin have demonstrated that a simple sugar solution helps improve conditions created by Alzheimer's disease. In tests with mice, the researchers found that treatment with several types of a sugar known as inositol eliminated several types of amyloid plaques, reduced inflammation and improved cognitive function. The next step is to begin testing in humans.
- CIHR-supported researchers Drs. Ian Mackenzie and Howard Feldman have discovered a gene mutation responsible for a common form of dementia in persons under 65. The mutation, found in the progranulin gene, causes an inherited form of frontotemporal dementia (FTD). The team hadn't expected to find these mutations and the discovery now opens the door to possible treatment for FTD. Both researchers are affiliated with the University of British Columbia and the Vancouver Coastal Health Research Institute.
- A team of CIHR-supported researchers from Université Laval, lead by Dr. Serge Rivest, may have discovered a new tool in the fight against Alzheimer's disease. The team discovered that when they used bone marrow stem cells to produce immune cells known as microglia, these cells were able to digest plaque created by Alzheimer's. Microglia are present in persons with Alzheimer's but, in their natural form, are unable to eliminate the plaque.
- According to research by CIHR-supported researcher Dr. Vladimir Hachinski of The University of Western Ontario, a stroke may trigger worsened symptoms of Alzheimer's among persons predisposed to the disease. In his study, rats were injected with a protein known to cause Alzheimer's that leads to some behavioural changes. Dramatic changes were seen when the researchers later induced a stroke into the brain cores of the rats. The study draws attention to the need for even greater control of risk factors for strokes.

The Researchers... Dr. Peter Nguyen – Learning What Keeps the Aging Brain Flexible

It turns out that some of the popular sayings are true, at least scientifically speaking. Consider the expression *use it or lose it*.

“I would say that is totally accurate,” says CIHR-supported researcher Dr. Peter Nguyen of the University of Alberta, who adds that exercising your brain helps maintain a sharp mind as you age.

Dr. Nguyen is a specialist in the field of brain plasticity, in other words, the capacity to learn new information and to store memories. Research in this area is important in helping to understand and counter the effects of numerous neurological disorders such as Alzheimer’s disease.

Two main types of plasticity exist. The first is purely structural. To imagine this, picture the following: individual brain cells, or neurons; long axons or fibres that extend out from the neurons; an elaborate system of dendrites branching out from the axons; and so-called synaptic junctions that help make connections between neurons.

With structural plasticity your brain uses these elements to constantly build and re-build new networks to respond to new stimuli and to help create records or memories of these events. This plasticity takes on more importance given the rapid rate at which we lose the neurons necessary for these functions. According to Dr. Nguyen, plasticity becomes a hedge against the ravages of time.

“Our neurons are constantly in flux because we lose tens of thousands each day. We can’t generate new cells, so we have to constantly re-use and rewire these circuits to make use of what we have,” he notes.

The second type of plasticity refers to the strength with which these signals are transmitted, something called physiological plasticity. In this case, much the same way as a guitar string changes pitch depending on how tightly it is strung, plasticity can either boost or weaken the strength of the signal.

Many questions remain. For example, researchers are still trying to understand how these different types of plasticity are related to specific brain functions. Dr. Nguyen is also trying to better understand the chemical and molecular events that contribute to these different forms of plasticity.

“We have identified molecules for some different types of plasticity, but we don’t know yet which form of plasticity is best for slowing down Alzheimer’s,” he notes.

One of the long-term goals of the research is to help develop drugs that would assist the work of these molecules in maintaining plasticity. As appealing as this sounds, Dr. Nguyen cautions against what he calls a “magic pill” for memory. “Producing a drug to enhance memories is a challenge. You have no idea how difficult life would be if every memory adhered to your brain like Teflon,” he concludes.

- Cell death is an important function in the human body and all cells have the ability to, in effect, die on command. This programmed response, called apoptosis, is quite useful in eliminating cancerous cells, but can also result in cells dying prematurely, such as with Alzheimer’s disease. CIHR-supported researcher Dr. Peter Greer of Queen’s University has found a protein called calpain that can both promote and inhibit programmed cell death. The finding will help researchers find ways to blocking the premature death of neuronal cells in Alzheimer’s patients.
- Good news for tea drinkers. A CIHR-supported research team from the Douglas Hospital, McGill University, has demonstrated for the first time that extracts from both green and black teas are effective at protecting neurons from amyloid plaque created by Alzheimer’s disease. Previously, studies have shown that extract drawn from green tea has the potential to combat a variety of different diseases, Alzheimer’s included. The benefits of black tea may be at a lower intensity, but the study shows that benefits do exist.
- CIHR spinoff, Amorfix Life Sciences Ltd. of Toronto, has partnered with the Ontario Genomics Institute to accelerate development of the first-ever blood test for Alzheimer’s disease. The test is based on Amorfix’s Epitope Protection technology, which is also being adapted to detect bovine prions, the infectious aggregated misfolded proteins that cause bovine spongiform encephalopathy (BSE). Amorfix was founded with a grant from CIHR’s Proof of Principle program to commercialize the discoveries of CIHR-supported researchers Drs. Neil Cashman and Marty Lehto of the University of Toronto.

In the Pipeline... Understanding the Quality of Life for Alzheimer’s Patients

How does the quality of life for Alzheimer’s disease patients change as the condition worsens? How does patients’ own rating of their quality of life compare with the rating given by their caregivers? Dr. Gary Naglie, a researcher at the Toronto Rehabilitation Institute, aims to find out through a study with participants from memory disorder clinics in Halifax, Montreal, Ottawa, Whitby, Toronto, Hamilton, London, Calgary and Vancouver. The team will use a variety of different measures to try and provide greater insights into quality of life in this patient population. An earlier pilot study has already found that, generally speaking, patients rated their quality of life much higher than their caregivers did, a fact that raises interesting questions according to Dr. Naglie.



CIHR IRSC
2005-2006

Arthritis

The CIHR Institute

CIHR's Institute of Musculoskeletal Health and Arthritis' work is literally out of this world – among other important projects, the Institute is working with the Canadian Space Agency to fund research on long-term bed rest and bone loss in space flight. An active member of the Canadian National Action Network, the Institute is also an avid supporter of the Bone and Joint Decade launched by the World Health Organization and endorsed by the United Nations in 2000.

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The Canadian Institutes of Health Research (CIHR) is the Government of Canada's agency for health research. Through CIHR, the Government of Canada invested approximately \$19 million in 2005-06 in research on arthritis across Canada.

The Facts

- Arthritis comprises more than 100 conditions including lupus, fibromyalgia, gout, temporomandibular joint pain and scleroderma.
- The most common type of arthritis in Canada is osteoarthritis, affecting three million Canadians, or 1 in 10. Long-term disability accounted for almost 80% of the economic costs of arthritis in 1998, at nearly \$3.5 billion. The 35-64 year age group incurred 70% of these costs.
- Rheumatoid arthritis is the second most common type of arthritis, affecting 300,000 Canadians, or 1 in 100. It is an autoimmune disorder, in which the immune system attacks healthy joints, resulting in damage to cartilage, bone, tendons and ligaments. Twice as many women as men get rheumatoid arthritis. It most commonly appears between the ages of 25 and 50.
- Two thirds of those with arthritis are women and nearly 60% are under the age of 65.
- For all age groups, arthritis disables two to three times more workers than all other chronic conditions.
- Epidemiologists predict there will be about 100,000 new cases of arthritis each year for the next 30 years. It is estimated that by 2026, more than six million Canadians over the age of 15 will have arthritis.
- Over 4 million Canadians are afflicted by musculoskeletal (MSK) diseases and conditions – 90% in the form of osteoarthritis.
- MSK diseases cost Canadians \$16.4 billion every year, the second highest cost of disease after heart disease. Of this total, \$2.6 billion is in direct costs such as physician and hospital care and drugs, and \$13.7 billion is in indirect costs including premature disability and death.

Research Finding Solutions to Arthritis Problems

- Cost-sharing for prescription drugs is common in Canada; while arrangements differ, users usually pay a portion of all the costs up to a maximum beyond which there is no or a minimal charge for the drug. According to a study of elderly patients suffering from rheumatoid arthritis, patients were much more likely to visit the doctor or hospital during periods when they had to pay drug fees. The study, conducted by CIHR-supported researcher Dr. Aslam Anis and other team members from St. Paul's Hospital in Vancouver, suggests that, in a predominantly publicly-funded healthcare system, cost-containment strategies may be backfiring because users are treating healthcare services as alternatives to prescription drugs.
- No one, it seems, likes to admit they're in pain. According to studies by CIHR-supported researcher Dr. Gillian Hawker of the University of Toronto, this is clearly the case with elderly persons suffering from osteoarthritis (OA). In interviews with persons with OA, respondents expressed reluctance to take painkillers even if they had been prescribed, putting pressure on their families and the healthcare system. The research highlights the need to rethink how painkillers are prescribed and how pain is managed for older patients with OA.
- CIHR-supported researcher Dr. Jason McDougall of the University of Calgary has taken the first steps towards better understanding pain in persons with arthritis and finding new, non-addictive drugs to control this pain. In testing with rats, a new type of pain reliever called

endomorphin 1 worked well in cases where knee joints had one-time, acute inflammation. But the same drug had no effect on joints with chronic inflammation. The research provides valuable information needed to help find ways of making the medication work for persons with chronic arthritis.

- Managing a chronic illness while keeping a job is a major issue for people with such illnesses. CIHR-supported researcher Dr. Monique Gignac of the Toronto Western Research Institute, University Health Network, is studying how people with arthritis cope with such a situation. She has found that such people have several different ways of coping, such as asking for help, modifying one's activities, changing one's behaviour and simply planning ahead to avoid anticipated problems. Arthritis sufferers reported using far fewer of these coping behaviours at work, using them mainly in their personal life. So-called "anticipatory coping" was most common in the workplace. The research provides important information for policy-makers in understanding the burdens of chronic illness and how best to address these needs.
- Many bone and joint conditions are chronic diseases, creating lifelong challenges for patients in managing their health. CIHR-funded researcher Dr. Peter Tugwell of the University of Ottawa, in partnership with an organization called the Cochrane Collaboration, is documenting the kinds of skills healthcare consumers need to effectively manage their conditions. Skills fall under categories such as how to use health information to make decisions, communicating with others, clarifying values and priorities and negotiating their role as a patient. The list will be used to develop a tool for helping ensure that healthcare consumers get what they need from the healthcare system at all points during the course of their disease.

In the Pipeline... Increasing Mobility for Persons with Osteoarthritis

Current research supports the view that a healthy musculoskeletal system is central to an individual's ability to be mobile and physically active. In one CIHR-funded project currently underway, Dr. Catherine Arnold of the University of Saskatchewan is undertaking a two-year clinical trial to study the effect of aquatic exercise and aquatic exercise combined with education on reducing the risk of falls in older adults with hip osteoarthritis. Among older adults, hip fractures from falls are particularly devastating, often resulting in death or admission to long-term care. Because seniors with hip osteoarthritis often suffer from pain, they find it difficult to participate in exercise programs designed to improve balance, strength and mobility – and reduce falls. If Dr. Arnold is able to demonstrate which fall prevention programs would be most effective, it may be possible to avert death resulting from hip fractures and loss of quality of life for these older adults.

The Researchers... Dr. Steven Boyd – Seeing is Believing

The small South Okanagan town of Oliver, B.C., (pop. 4,500) now has two famous sons: Canada's first Parliamentary Poet Laureate George Bowering and, perhaps somewhat less known but no less deserving, Dr. Steven Boyd.

Dr. Boyd, a mechanical engineer and associate professor at the University of Calgary (U of C), is one of a growing number of researchers with roots in mechanical engineering who are applying their expertise and generating results in the field of health research.

"I have to be careful that, every once in a while, I publish in an engineering journal, just to remind people I'm still an engineer," Dr. Boyd jokes.

Dr. Boyd is a key player on several CIHR-supported projects and counts a number of different faculty members at the university as collaborators. Projects involve research into conditions such as osteoporosis and osteoarthritis and make use of a powerful imaging technique known as CT scanning to detect and track changes in bone structure. CT scanning provides highly detailed 3-D images of bones.

"I love to be able to look inside a structure and see what's going on with a really high degree of accuracy. With this approach we are able to focus on and answer important clinical questions," he says.

One question involves the impact of injuries on osteoarthritis. As an example, a single knee injury as a teenager or young adult can triple the risk of osteoarthritis in that knee by middle age.

According to Dr. Boyd, one of the reasons for this statistic is that the initial injury actually creates significant bone loss, affecting bone strength which, in turn, affects the cartilage. As the saying goes, a house is only as strong as its foundation and, in this case, when the joint or foundation becomes compromised, weaker tissues such as cartilage, as Dr. Boyd puts it, "simply go along for the ride".

In studies with mice, Dr. Boyd, in collaboration with Dr. Ronald Zernicke, also with the U of C, used CT scans to demonstrate that 40% of bone loss occurs within three months of the injury. The team has also been experimenting with osteoporosis drugs as a way to prevent this bone loss and, consequently, the onset of osteoarthritis.

"Patients never present themselves until they are in pain. By this time, the initial injury has created changes in the bone and things have stabilized in a bad way. The bone is no longer providing the optimal foundation for the cartilage. We're trying to prevent these changes so that the patient never reaches the clinic in the first place," Dr. Boyd comments.

The CIHR Institute

CIHR's Institute for Cancer Research has been coordinating cancer research across Canada in priority areas such as palliative and end-of-life care, establishing a model for the world. Other priorities run the range from molecular profiling of tumours to early detection of cancer, to preventing the risk behaviours that can lead to cancer.

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The Canadian Institutes of Health Research (CIHR) is the Government of Canada's agency for health research. Through CIHR, the Government of Canada invested approximately \$118.3 million in 2005-06 in cancer research across Canada.

The Facts

- Canada is facing a cancer epidemic over the next 20 years, due to our aging population. If current trends continue, 5.7 million Canadians will develop cancer and 2.7 million will die of the disease over the next 30 years.
- An estimated 153,100 new cases of cancer and 70,400 deaths from cancer will occur in Canada in 2006.
- Lung cancer is the leading cause of cancer death for both men and women. Overall, colorectal cancer is the second leading cause of death from cancer.
- Canadians aged 70 and over represent 43% of new cancer cases and 60% of deaths due to cancer.
- 38% of Canadian women and 44% of men will develop cancer during their lifetimes based on current incidence rates.
- 24% of women and 29% of men, or about a quarter of all Canadians, will die from cancer, based on current mortality rates.
- Smoking is responsible for 27% of potential years of life lost due to cancer.
- Cancer costs Canadians more than \$14 billion every year. Of that total, \$2.5 billion is for direct costs such as hospitalization and medication, while \$11.8 billion is for indirect costs such as early death or disability.

Research Finding Solutions to Cancer

- CIHR-supported researcher Dr. Georg Bjarnason, from Sunnybrook Health Sciences Centre in Toronto, has determined that head and neck cancer patients who receive high doses of radiation in the morning have a greater chance of avoiding mucositis (a severe irritation of the throat and mouth). In his study, Dr. Bjarnason discovered that only 43% of patients who received radiation therapy in the morning developed mucositis, compared to 67% in the afternoon. The discovery could have implications for other cancer therapies with equally serious side effects.
- So-called "natural killer" (NK) cells recognize and kill cancer cells. Health research teams have been trying for many years to find out how to increase NK cell activity. Now, CIHR-supported researcher Dr. André Veillette, from the Institut de recherches cliniques de Montréal, has discovered that a protein called EAT-2 slows down the function of natural killer (NK) cells. If medications that suppress EAT-2 in humans can be developed, Dr. Veillette believes that NK cells will likely increase and work in conjunction with chemotherapy and radiotherapy to improve the effectiveness of cancer treatments.
- The spleen, which filters and produces blood, is not considered essential for normal body function. But CIHR-supported research Dr. Yaacov Ben-David, from Sunnybrook Health Sciences Centre in Toronto, has determined that the spleen in diseased mice can play a role in the development of leukemia. Some of the growth factors released by the spleen, such as MCP and VEGF, may promote the development of leukemia-based cells, as well as breast and other types of cancers. Should Dr. Ben-David's discovery prove to be equally true in humans, the development of new drug therapies or even the removal of the spleen through surgery could become treatment possibilities.

- It's been known for some time that the overproduction of a protein known as c-Myc plays a key role in the development of cancer. Work by CIHR-supported researcher Dr. Sabine Mai of the University of Manitoba has uncovered a new function for this protein, demonstrating that when c-Myc is present at a certain level, the ends of chromosomes become "sticky" and join together. When the cell divides, these conjoined chromosomes break apart, but at a different location. This cycle continues as these now altered chromosomes attract new chromosomes and break in new locations, creating genetic instability and leading to uncontrolled growth of cells. New insights into how cancer develops are key to finding new ways to diagnose and treat cancers.
- Dr. Peter Forsyth, from the University of Calgary, and Dr. Grant McFadden, from the Robarts Research Institute in London, Ontario, have shown for the first time that a live poxvirus, called the myxoma virus, can kill human brain tumours in mice. In their cross-country, collaborative study, Drs. Forsyth and McFadden, both recipients of CIHR funding, showed that the poxvirus eradicated human gliomas, or terminal brain tumours, in 92% of the mice tested. Only cancer cells died, while all other healthy cells remained intact. Should further animal testing prove to be successful, human clinical trials could start in about three or four years.
- Dr. Martin Yaffe, from Toronto's Sunnybrook Health Sciences Centre, has obtained evidence from a clinical trial that digital mammography is more accurate than film mammography in detecting breast cancer earlier in women who are under 50, have dense breasts, or are premenopausal. CIHR funding supported the development of the new digital mammography technique.

In the Pipeline... Addressing the Challenge of Breast Cancer

A research team lead by Dr. Michael Pollak from McGill University and including researchers from Université Laval, UBC and Mount Sinai Hospital is investigating the possibility that Vitamin D deficiency and high levels of insulin could increase breast cancer risks. Joint funding from CIHR and the Canadian Breast Cancer Research Alliance is helping to support the research.

The Researchers...

Dr. Peter Cheung – Mapping What Lies Beyond the Human Genome

Major accomplishments are never the end of the story. More often, they're an invitation to begin a new chapter. That's certainly the case in the field of genetics and it clearly applies to Dr. Peter Cheung, who is exploring the complex factors controlling gene regulation, research with future uses in cancer treatments.

"The human genome sequencing and gene mapping projects gave us a lot of information. Now we need to go to the next step and figure out how all of these genes are regulated and how changes in the environment can cause genes to switch on or off," notes Dr. Cheung. This new field is known as epigenetics.

For Dr. Cheung, a CIHR New Investigator and Assistant Professor at the University of Toronto, understanding gene regulation is essential in understanding cancer, which, in plain terms, represents a failure in this regulation.

"There are more than 200 different cell types in the body, each with a highly specialized function. Each of these cells has the same copy of genome sequences. But for them to carry out their own special functions, each cell type has unique sets of genes that are expressed. Regulation is like directing traffic – telling the cell which genes are needed, and thus activated, and which ones are not required and therefore can be silenced," he says.

Key to this puzzle, Dr. Cheung is studying chemical modifications made to a group of proteins known as histones. DNA is always spooled around histones, like silk thread around a bobbin, to make chromosomes. Histones, therefore, control the accessibility of the DNA and genes. Histones have "tails" which can attract various chemicals, an acetyl group here, a methyl group there, and so on.

These chemicals, in turn, change the tension of the DNA spool. An acetyl, for example, is like a muscle relaxant, causing the DNA to loosen. In this state, it gives access to so-called transcription factors that, ultimately, will lead to gene activation. Methyl groups create the opposite effect.

With cancer, these seemingly distant and minor chemical modifications can end up having a major impact, e.g. a tumour suppressor might accidentally get turned off and result in the development of cancer. Dr. Cheung's research points to new opportunities for cancer therapies, efforts that focus less on the DNA sequences of genes and more on the machinery controlling them.

"We are just beginning to understand the different players involved in histone modifications, and we're now trying to focus on how they work together to regulate gene expression. We need to find the right chemicals to help tweak these players, to find activators and inhibitors which will create better control and better outcomes," Dr. Cheung concludes.

The CIHR Institute

From fertility and healthy pregnancy to improving outcomes for adolescents, CIHR's Institute of Human Development, Child and Youth Health is building the life foundation for tomorrow's adults, helping to ensure that all children have the best possible start in life and achieve their potential for optimal growth and development.

About CIHR

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The Canadian Institutes of Health Research (CIHR) is the Government of Canada's agency for health research. Through CIHR, the Government of Canada invested approximately \$58.5 million in 2005-06 in research on child health across Canada.

The Facts

- Canada's infant mortality rate – the number of deaths in children under one year of age per 1,000 live births – in 2001 was 5.2. As of 1996, with the exception of Japan, Canada had the most dramatic decline in infant mortality rates in the previous 35 years – from 27.3 deaths in 1960 to 5.6 in 1996. Nonetheless, several countries, including Japan, Finland and Sweden, have lower infant mortality rates.
- Cancer, although rare, is the most common potentially fatal illness among Canadian children and the second leading cause of death among children aged 1 to 14 (injury is the leading cause of death). Three-quarters of children with cancer are cured, up significantly from 5% 40 years ago. Leukemia and brain tumours are the most frequently diagnosed cancers in children.
- Attention deficit hyperactivity disorder (ADHD) is the most common childhood behavioural disorder, occurring in 3 to 5% of school-aged children. Boys are four times more likely to be diagnosed with ADHD than girls.
- Autism and pervasive developmental disorders (PDD) affect an estimated 2 to 5 people per 10,000. Some studies suggest rates may be as high as 20 people per 10,000.
- Asthma is the most common respiratory disease in children. It is responsible for more than one-quarter of all school absences.
- In 2004, 18% of children aged 2 to 17 were overweight and 8% were obese – accounting for more than one-quarter of all children.
- Poverty is a major determinant of children's health. Almost all facets of health are worse among impoverished children than among children from more affluent families.
- Babies and their mothers account for about 10% of all spending for inpatient care in Canadian hospitals.

Research Finding Solutions for Children's Health

- Amnioinfusion – the infusion of saline into the uterus – does not reduce the risk of meconium aspiration syndrome (MAS), according to a CIHR-funded international randomized trial led by Dr. William Fraser at the Université de Montréal. MAS, while rare, is a severe neonatal lung infection that occurs when a newborn inhales a mixture of meconium and amniotic fluid during labour and delivery. Meconium is the material that fills the fetal intestinal tract during pregnancy. When inhaled, it can cause a partial or complete blockage of the baby's airway when it exhales, making it hard to breathe. Amnioinfusion has been used for the past 15 years to reduce the risk of MAS by diluting the meconium; Dr. Fraser's research has demonstrated that it is ineffective for this purpose.
- Many of the conditions that affect children are difficult to diagnose early. CIHR-funded researchers are changing that. A simple test developed by Dr. James Reynolds of Queen's University measures eye movements to identify children with Fetal Alcohol Spectrum Disorder (FASD), for which there are currently no objective diagnostic tools. At Dalhousie University, a team headed by CIHR-funded researcher Dr. Susan Bryson has developed the Autism Observation Scale for Infants (AOSI), which pinpoints specific behavioural signs in infants as young as six months to a year that can predict whether a child will develop autism; existing diagnostic tools have been designed for children 18 months and older. Both of these tests could lead to earlier treatments for these debilitating conditions.

- Caffeine is generally thought of as an adult stimulant, but CIHR-funded research has found that it may help regulate the breathing of very premature babies. A study by Dr. Barbara Schmidt of McMaster University found that about a third of infants treated with caffeine for apnea – interrupted or irregular breathing due to their prematurity – required extra oxygen, compared to nearly half of those who received a placebo. The latter group also needed an extra week of ventilator therapy to support their breathing, compared to the babies who received caffeine. Apnea occurs in about 85% of babies born prior to 34 weeks gestation.
- Fewer than half of Canadian children are active enough for basic healthy development according to a national report card issued by the Active Health Kids Canada, the development of which was supported by CIHR. Boys were found to be more physically active than girls, and activity level increased from east to west across the country. Meanwhile, CIHR-funded researchers Drs. Bonnie Leadbeater and Mikael Jansson of the University of Victoria have found that nearly 40% of adolescents surveyed suffered an injury in the previous year serious enough to limit their daily activity. Now the research team is investigating whether such injuries discourage young people from playing the games they love and help to turn them into couch potatoes.
- Against all expectations, the majority of extremely low birth weight infants born in the late 1970s and early 1980s are little different than their normal birth weight counterparts when it comes to education, employment and independence as young adults, according to a CIHR-funded study by Dr. Saroj Saigal of McMaster University. Their achievement came as a surprise to researchers, as fully one-quarter of them have disabilities. The first generation of infants to survive being born at extremely low weights (1.1 to 2.2 lbs. at birth) is just now coming to young adulthood.

In the Pipeline... Hope – The Complex Journey of Parents of Children with Cancer

Despite tremendous improvements in outcomes for children with cancer, a significant proportion of these children will not live into adulthood – and their parents will live with their deaths for the rest of their own lives. Dr. Beverley Antle of the Hospital for Sick Children, University of Toronto, wants to improve the quality of care that both children and their parents receive at the end of the children's lives. She is focusing on the hope parents feel and the impact this has on their choices on behalf of their children, as well as how that hope changes over the course of their child's treatment and decline. Her research will open new windows on the factors and events that influence what parents hope for when their child's health declines and curative treatment is no longer possible. The knowledge will help to improve the quality of care offered to children with cancer and their parents.

The Researchers... Dr. Sunita Vohra – Giving Doctors More Tools

Dr. Sunita Vohra has a vision. It involves changing conventional wisdom that new medicines and therapies start at the lab bench and end at the patients' bedside.

“What if things went the other way, starting from the bedside and ending at the bench?” asks Dr. Vohra, professor of pediatrics at the University of Alberta and director of the Complementary and Alternative Research and Education Program (CARE) at the Stollery Children's Hospital.

She notes that natural remedies and therapies already have a place at the bedside. Outside of North America, 80% of the world's population uses alternative medicines and practices. In the pediatrics practice, 70% of patients seen at children's hospitals across Canada are using such treatments.

The opportunity for researchers is to collect information about these therapies and design experiments that they will test to see which ones have the most benefits for different conditions.

“There is a tremendous amount of activity taking place, a kind of vast natural experiment occurring that demands that we take a closer look to see what is being used, what is working and why. There is a huge potential for new drugs and for expanding our understanding of diseases and health,” Dr. Vohra notes.

As director of the CARE program, Dr. Vohra is trying to do precisely that. Stollery is the only children's hospital in Canada to have introduced additional clinical services in these complementary and alternative medicines. As an example, the use of acupuncture is being explored to minimize nausea and vomiting related to chemotherapy.

“The fact is that, as a doctor, you have to be educated and prepared for questions from parents about these treatments,” Dr. Vohra stresses. “This involves changing the definition of ‘mainstream’ evidence-based medicine. The exciting thing is: What are the next new hypotheses about disease we're going to generate when we change this perspective?”



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CIHR Commercialization Strategy

CIHR's strategy for commercialization and innovation rests on the following principles:

Research – Make strategic investments in targeted research to realize the promise of discoveries reached through basic research.

Talent – Build a talented pool of commercialization professionals, people with a combination of entrepreneurial drive, research know-how and management expertise.

Capital – Stimulate investment in this high-risk sector by helping clarify the commercial potential of early stage technologies.

Linkages – Facilitate interactions and partnerships with the private sector, finance and health research communities at all stages of the innovation pipeline.

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Commercialization

The Canadian Institutes of Health Research (CIHR) is the Government of Canada's agency for health research. The Government of Canada, through CIHR's dynamic and innovative commercialization strategy, invested \$12.5 million in 2005-06 in helping researchers take their discoveries a step closer to market.

The Innovation Index

- In 2005, there were 459 biotechnology companies in Canada (378 private, 81 public).
- In 2005, there were 446 biopharmaceutical products in the pipeline. Of these, the majority were at the research (147) and pre-clinical (133) phase.
- Revenues for 2005 increased by 26% from the previous year to more than \$2.5 billion.
- Venture capitalists invested more than \$313 million in private biotech firms in 2005.
- The average investment rose from \$2.4 million in 2004 to \$6.1 million in 2005.
- Canada's biotech industry employed 75,488 people in 2003.

CIHR Spinoffs Attracting Investment and Success

- In March 2006, Neuromed signed a licensing deal with Merck & Co., Inc. worth potentially US\$475 million, the largest biotech licensing deal in Canada's history. Neuromed was founded by Dr. Terry Snutch of the University of British Columbia, based on knowledge gained through more than \$5 million in CIHR-funded research over the years. Neuromed is the only biotech company in the world focused exclusively on developing calcium channel drugs for the treatment of human diseases. Calcium channels are involved in many physiological processes, including muscle contraction, hormone secretion and electrical signaling in the nervous system. Changes in calcium channels can lead to illnesses including migraine headaches, epilepsy, hypertension and stroke.
- To prevent humans from getting the variant Creutzfeldt-Jakob disease (vCJD) from tainted meat or from blood transfusions, there is a need for a simple blood test that can be used in both cattle and in humans. A CIHR Proof of Principle (POP) grant helped establish a spinoff company, Amorfix Life Sciences Ltd., based in Toronto, which is now accelerating development of this technology. In the past year, the company has gone public on the Toronto Stock Exchange. Now, Amorfix has announced plans to extend this technology into a blood test for early detection of Alzheimer's disease. Amorfix is based on the work of CIHR-funded neuroscientist Dr. Neil Cashman from the University of British Columbia.
- The past year has been eventful for Viron Therapeutics, a company based on the research of CIHR-supported researcher Dr. Grant McFadden of The University of Western Ontario. Recently, Viron raised \$25 million in new funding. Viron is developing medicines targeting inflammatory-based disorders including acute coronary syndromes, transplant rejection, inflammatory bowel disease and rheumatoid arthritis. The company's lead compound is now in Phase II clinical testing.
- Victoria, B.C.-based Aspreva Pharmaceuticals went public in the past year with the largest biotech initial public offer in the world for 2005. Adding to the company's reputation as a performer, Aspreva, which employs more than 100 people, was recently added to the NASDAQ

Biotechnology Index. Initial pilot funding from CIHR helped company co-founder Dr. Michael Hayden of the University of British Columbia test an existing drug for a new indication, Huntington's disease. Based on the success of this trial, Aspreva was created to help make use of existing drugs for less common and neglected diseases. Currently, the company has several clinical trials underway to test the effectiveness of a drug originally designed to prevent rejection of kidney transplants. Aspreva is testing the drug for several autoimmune disorders such as lupus.

Investing in New Companies

The Proof of Principle (POP) program provides funding to help bridge the growing gap between academic research and the point where early-stage investors enter the picture. Since 2001, more than 160 projects have been funded. Of the projects that have matured sufficiently to be evaluated, 63%, or 49 projects, resulted in new patents being funded; 21%, or 16 projects, had intellectual property licensed; and 14%, or 11 projects, contributed to new company formation. Some current projects are listed below.

- Dr. Marcel Bally of the B.C. Cancer Research Centre received POP funding to test new technology for delivering the cancer drug Irinotecan, used most commonly to treat bowel cancer. Dr. Bally has developed an improved method for getting more of the drug into liposomes, which resemble microscopic water balloons and are used widely as a drug delivery tool. The project will also test to see if the method is applicable to other anticancer drugs.
- Dr. Min Wei-Ping of the London Health Sciences Centre, The University of Western Ontario, is using POP funding to evaluate new ways of suppressing genes that damage organs awaiting transplantation. Damage to these organs has an impact on their long-term survival in transplant recipients, which remains low. The project investigated a method for preventing organ damage before transplantation and stopping immune rejection after transplantation.
- Dr. David Byers of the IWK Health Centre, Dalhousie University in Halifax, received POP funding to create a novel antibiotic to treat conditions such as pneumonia, gastrointestinal disease and meningitis. To do it, he's focusing on interfering with one of the key enzymes needed by bacteria to create endotoxin, which is found in the outer membrane of certain types of bacteria. Using computer modelling, Dr. Byers has already designed and synthesized a molecule that can inhibit a key player in endotoxin synthesis. POP funding will help develop and commercialize this initial work into a pre-clinical drug candidate.

Investing in Capacity

CIHR is creating the tools and programs that will help build successful commercialization and knowledge translation activities within Canada's health research community.

In 2005-06, CIHR awarded the first round of funding under its new Science to Business (S2B) program to business schools in B.C., Saskatchewan and Ontario. The S2B program provides grants to help business schools recruit talented PhD graduates with training in health research into health-oriented Masters of Business Administration (MBA) programs.

The Tri-Council Intellectual Property Mobilization Program has provided funding to a unique partnership among the technology transfer offices of McMaster University, University of Waterloo, University of Guelph and The University of Western Ontario. Under the partnership, the four universities will pool their technology transfer expertise, building horizontal teams on life sciences and physical sciences as well as groups in patent administration and industrial interaction. Potential private sector partners looking for new and innovative technologies will be able to tap into the intellectual property of four research-intensive universities using a single contact point.

The CIHR Institute

CIHR's Institute of Nutrition, Metabolism and Diabetes, under the leadership of Scientific Director Dr. Diane Finegood, is leading the charge in the fight against diabetes. Through its strategic focus on obesity, the Institute is helping to shed light on one of the key risk factors for type 2 diabetes.

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The Canadian Institutes of Health Research (CIHR) is the Government of Canada's agency for health research. Through CIHR, the Government of Canada invested approximately \$30.8 million in 2005-06 across Canada in research on diabetes.

The Facts

- In 2000, 1.4 million people in Canada had diabetes. This number is projected to increase to 2.4 million by 2016.
- More than 8% of deaths in Canada are attributable to diabetes-related complications.
- Type 1 diabetes is usually diagnosed in childhood and involves an abnormal autoimmune response that destroys insulin-producing cells in the pancreas, resulting in little or no insulin production.
- Type 2 diabetes typically begins in adulthood, although more and more children are developing the disease. Type 2 diabetes develops as the body's cells become more and more resistant to the effects of insulin.
- People who have a family member with diabetes, are physically inactive or are overweight are at higher risk of developing the disease.
- Both type 1 and type 2 diabetes are due to a combination of genetic and environmental factors.
- About 90% of people with diabetes have type 2; 10% have type 1.
- Complications of diabetes include nerve damage, cardiovascular disease, blindness, kidney disease and impotence.
- The economic cost of diabetes was estimated at \$1.6 billion in Canada in 1998. Approximately 75% of this figure stems from indirect costs, including factors such as lost production due to long-term disability and premature mortality.

Research Finding Solutions to Diabetes

- New research by Dr. Peter Light of the University of Alberta suggests why high-fat diets are not just bad for your heart, but can lead to type 2 diabetes. To send signals critical for many different biological functions, the body uses a network of channels into and out of cell membranes. High-fat diets interfere with one particular channel involved in metabolism, affecting insulin secretion, which contributes to type 2 diabetes.
- The groundbreaking Edmonton Protocol allows insulin-producing islet cells to be transplanted into people suffering from type 1 diabetes to replace the lack of these cells. Research by CIHR-funded Dr. John Elliott at the University of Alberta could make the process more efficient and readily available. Dr. Elliot has found a protein that, when encouraged to overproduce, increases the survival rate of cells during transplant. The result could mean that instead of requiring multiple donors to harvest enough cells to treat a single patient, just a few will be necessary.
- CIHR-funded University of Alberta researcher Dr. Alexander Rabinovitch is also helping solve the problem of shortages of donated tissue needed for islet cell transplantation. Using cell culture techniques and the hormones gastrin and epidermal growth factor, he successfully stimulated more insulin-secreting cells to grow in engineered tissue. The result will eventually help reduce demand for donor tissue, which is not plentiful.

- Improving your lifestyle by eating better and getting more exercise may not be enough for many people to get their type 2 diabetes under control, according to CIHR-funded researcher Dr. Stewart Harris at The University of Western Ontario. Even though most primary care physicians prescribed exactly this treatment, research found that many patients with type 2 diabetes are not reaching their targets in glycemic control, which creates other serious health problems. Better alternatives or more aggressive treatment techniques must be used in order to improve the success rate of primary care.
- Self-confidence and strong social networks help teenage girls establish control over type 1 diabetes. Dr. Gary Rodin's lab at the University of Toronto found that social acceptance, romantic appeal and close friendships improved control over metabolism.

In the Pipeline... Managing Diabetes Care Now and for the Future

Diabetes is now recognized as a reliable risk factor for heart disease and other serious illnesses. The DREAM Trial, on which Dr. Hertzell Gerstein of McMaster University is taking a lead position, is testing the drugs ramipril and rosiglitazone for the prevention of diabetes as well as atherosclerosis. When the research is completed, Dr. Gerstein will be able to say if these two drugs can effectively combat type 2 diabetes and atherosclerosis, thereby making a new method of diabetes treatment available to the public.

The Researchers... Dr. Jill Hamilton – Searching for Early Signs of Diabetes

Dr. Jill Hamilton is a researcher at the Hospital for Sick Children (SickKids), University of Toronto, and is interested in studying children at risk for diabetes long before the disease occurs.

“I think one of the aspects of my work that is most interesting is that we have an opportunity to intervene very early to treat and even prevent disease from happening,” she comments.

So, it may come as a surprise that the area of research of concern to Dr. Hamilton is type 2 diabetes, also known as “late-onset” diabetes because it tends to affect older generations. But according to Dr. Hamilton, type 2 diabetes is an extremely complex disease that can be triggered by environmental and genetic factors. And her hope is that these factors can be caught early, very early in fact.

Dr. Hamilton has begun work on a project involving infants, in the hopes of finding the first glimpse of what causes this disease and, ultimately, finding treatment options. She's working in partnership with co-primary investigator Dr. Anthony Hanley and co-investigators Drs. Ravi Retnakaran and Bernard Zinman of Mount Sinai Hospital, who are looking at the problem of gestational diabetes.

Dr. Hamilton's hypothesis is that babies who are exposed to maternal diabetes while in the womb may themselves be at risk for developing diabetes later in life. “When babies are exposed to high glucose levels and various other inflammatory molecules that impact on insulin action, there may be permanent reprogramming of pathways involved in glucose metabolism,” she notes.

With the project, Dr. Hamilton will be taking a number of body measurements of the children at three months of age and at 12 months. She will also be monitoring changes in fat tissue. At 12 months, Dr. Hamilton will take blood samples to test for insulin resistance and beta cell function as well as other indicators that could signal the early presence of type 2 diabetes.

“Working with kids at three months is pretty easy. At 12 months it's a little trickier. They've been used to waking up in the morning and being fed right away.” She adds, “The mothers are great about it because they've already been recruited into the maternal study, and they're committed to this research. That's been a very positive experience.”



CIHR IRSC
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Gender and Health

The CIHR Institute

CIHR's Institute of Gender and Health is the first research institute in the world to examine the health of women and girls, men and boys. It champions efforts to better understand how sex and gender influence access to the health system, chronic conditions and disabilities, health across the lifespan, health behaviours and addictions and environmental determinants of health.

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The Canadian Institutes of Health Research (CIHR) is the Government of Canada's agency for health research. Through CIHR, the Government of Canada invested approximately \$37.9 million in 2005-06 in research on gender and health across Canada.

The Facts

- Women experience more illness, more years of disability and more stress than men, but they also live longer. Even when diagnosed with a fatal disease, women survive longer than men.
- Life expectancy for women born in 2002 was 82.1 years, compared with 77.2 years for men. Between 1979 and 2002, life expectancy for men improved by 5.8 years while that of women improved by 3.3 years.
- Women are more likely than men to consider overall health and weight when choosing food, while men are more likely to engage in vigorous activity during their leisure time. As of 2004, 65% of males and 53% of females in Canada were considered overweight or obese based on the Body Mass Index or BMI.
- By age 65, 77% of men and 85% of women have at least one chronic condition. Arthritis is the most prevalent chronic condition.
- In 2002, more than 600,000 Canadians were dependent on alcohol and nearly 200,000 were dependent on illicit drugs. Men are more likely than women to drink heavily and use illicit drugs.
- A person's age and gender have a remarkable influence on their likelihood of experiencing poverty. Women are more likely to experience poverty. So are the young and the elderly. In fact, children and youth are over-represented in this group, accounting for more than 40% of the poor population.
- One in twelve Canadian children aged 4 to 7 in 1998-99 had witnessed violence at home. Children who witness violent behaviour are more likely to be overtly aggressive.

Research Finding Solutions to Gender and Health

- A study by Dr. Shari Brotman of McGill University has found that elderly homosexuals have a difficult time getting health and social services and, in a number of cases, face prejudice. Dr. Brotman conducted 90 interviews with elders, caregivers and health and social service providers in Vancouver, Montreal and Halifax. The study recommends better training and standards to respect patients' lifestyles and to give them the care they need.
- When kids, girls in particular, reach the age of 12, they enter a vulnerable period filled with conflicting information about what constitutes a healthy body type and weight. Dr. Gail McVey of the Hospital for Sick Children, University of Toronto, is developing tools and programs to help "vaccinate" students during this period and prevent risk factors that can trigger eating disorders such as anorexia nervosa and bulimia. Based on previous research, Dr. McVey's team has created a series of Web-based resources that can be used by teachers and students as part of their daily classroom activities. Lessons explore topics such as media literacy, healthy eating, the impact of teasing, the impact of adult role models and active living.
- Molar pregnancies, pregnancies that have no embryo, only placental tissue, affect approximately one out of a thousand women. Dr. Rima Slim from McGill University, in collaboration with partners from India, Pakistan, Lebanon and Germany, has, for the first time, linked this disorder with a particular gene mutation. The finding could lead to new screening and diagnostic tests.

- A CIHR-funded researcher from the Ottawa Health Research Institute, Dr. Andrée Gruslin, has found that an underactive enzyme could lead to miscarriage by interfering with the proper growth of the placenta. The gene that produces the enzyme can also result in the birth of underweight babies – called fetal-growth restriction. By identifying women with the gene Dr. Gruslin and her team hope to be able to monitor pregnant women and prevent stillbirths.

In the Pipeline... Gender Differences in Respiratory Diseases

Chronic Obstructive Pulmonary Disease (COPD) is the fourth leading cause of death in North America. Once considered a “man’s” disease, COPD is increasing in women. A new interdisciplinary research program at the University of British Columbia called ICEBERGS is studying the reasons why and building capacity for more research in this area. Led by Dr. Susan Kennedy, researchers will address physiological differences – women have larger airways which could result in more toxins being inhaled and deposited – as well as socio-economic and environmental factors. As a first step, team members, all experts in the area of respiratory diseases, are also re-examining their earlier research to see if different conclusions can be drawn if gender is considered.

The Researchers... Dr. Jacques J. Tremblay – Defining What it Takes to Be a Man

It’s at the heart of what it means to be a man but, strangely, it has not yet been the subject of a Motown hit song. Even within scientific communities, it has received little study, giving CIHR-supported researcher Dr. Jacques J. Tremblay a head start on his colleagues.

Dr. Tremblay, assistant professor in the Faculty of Medicine at Université Laval, is studying the function of what are known as Leydig cells, just one of some 200 different types of cells found in the human body. Each of these cells has its own specialized function and Leydig cells, found in testes, are responsible for producing steroids such as testosterone.

“I’m interested in understanding the gene expression events that make the Leydig cell what it is and that, ultimately, give it the capacity to produce steroids,” Dr. Tremblay notes.

To understand this process, Dr. Tremblay is studying what are known as transcription factors, proteins that help unravel and relay instructions contained in genes. It’s a long, complicated cascade of events involving signalling and communications between many different molecules during cell development and each has a specialized function.

“Collectively, these factors are working in what we’ve described as a kind of ‘combinatorial code’ – a unique combination or sequence of events at the molecular level that tells the cell to become what it is,” Dr. Tremblay explains.

According to Dr. Tremblay, such a detailed understanding is critical in helping to correct problems caused by the lack of certain hormones produced by Leydig cells.

Studies have suggested that maternal exposure to environmental pollutants known as phthalates (commonly found in cosmetics and flexible plastics) and excessive estrogen levels (having many causes, including medication, maternal obesity and the environment) cause reproductive disorders that target the male embryo, Leydig cells in particular.

“The Leydig cell is both the source of masculinity and its Achilles heel,” concludes Dr. Tremblay.



CIHR IRSC
2005-2006

Genetics

The CIHR Institute

CIHR's Institute of Genetics supports research on the human and other genomes and on all aspects of genetics, basic biochemistry and cell biology.

New advances in genetics and genomics, and in the understanding of how cells work, pose challenges to our healthcare system and often raise complex ethical, legal and social issues. The Institute is addressing these challenges to develop solutions that benefit Canadians.

About CIHR

The Canadian Institutes of Health Research (CIHR) is the Government of Canada's agency for health research. CIHR's mission is to create new scientific knowledge and to catalyze its translation into improved health, more effective health services and products, and a strengthened Canadian healthcare system. Composed of 13 Institutes, CIHR provides leadership and support to more than 10,000 health researchers and trainees across Canada.

The Canadian Institutes of Health Research (CIHR) is the Government of Canada's agency for health research. Through CIHR, the Government of Canada invested approximately \$189.9 million in 2005-06 across Canada in research on genetics.

The Facts

- The human genome is made up of 3 billion (3,000,000,000) bases of DNA, split into 24 chromosomes.
- This information...
 - would fill two hundred 500-page telephone directories;
 - would take a century to recite, if recited at the rate of one letter per second, 24 hours a day.
- The human genome contains about 20,000-25,000 genes.
- Genes contain instructions on how to make proteins which are responsible for carrying out all of the cell functions (examples – facilitating chemical reactions, controlling growth and transporting substances through the body).
- Many diseases stem from problems associated with proteins (examples – too many proteins produced, too few proteins, the protein is the wrong shape or “misfolded”).
- The proteome is the complete set of proteins produced by the genome at any one time, approximately 60,000.
- Proteomics is the study of proteins – what proteins look like (structure), interactions between proteins and the types of proteins expressed in different samples, such as healthy vs. diseased tissues.
- Currently, more than 900 genetic tests are available from testing laboratories.
- Between humans, our DNA differs by only 0.1%, or 1 in 1000 bases (letters).

Research Unlocking the Mysteries of the Genetic Code

- Dr. Jack Greenblatt of the University of Toronto has recorded the most comprehensive and reliable map of protein interactions in a living organism to date. His work, conducted with Dr. Andrew Emili, used sophisticated proteomic techniques to identify close to 4,000 proteins and 550 protein complexes involved in 7,123 protein-protein interactions in yeast cells. Disease results when these complexes and interactions go awry. The structure of proteins and their interactions in yeast cells are virtually identical to those in humans.
- Human organ transplants have to be completed at lightning-fast speed to make sure organs are fresh. An antifreeze protein in snow fleas, discovered by Drs. Laurie Brown and Peter Davies from Queen's University, may help extend the window, creating the possibility of more successful transplantations. With the new protein, organs could be safely stored at below the freezing point, preserving them for longer periods of time.
- To date, more than 1,000 genes have been identified for rare, highly heritable diseases, diseases that can be triggered by variation in only one gene. But many more common disorders are thought to be the result of numerous DNA variants acting together in response to environmental factors. In these cases, it is much more difficult to pinpoint the genetic source of disease, because of both the difficulty of tracking all the possible variations involved and understanding the relationship between these variations and between the variations and environmental factors. An international research group known as the International HapMap Consortium has created the world's first database containing information on more than one million instances of genetic variation and gives information on how these variations are linked. CIHR-supported researcher Dr. Tom Hudson of McGill University was the lead Canadian researcher on the study. The findings open major new possibilities in the search for causes of disease.

- Protein phosphorylation is one of the key tools that organisms use to regulate and control many basic cellular processes. Other proteins involved in these processes, such as enzymes and receptors, are turned on or off as a result of phosphorylation. Three CIHR-funded researchers have helped put together the first-ever phosphorylation map for yeast, charting 4,000 phosphorylation events involving 1,325 proteins. Information from this map can be applied to humans and may open the door to new drug therapies for diseases such as cancer, diabetes and AIDS. Dr. Michael Snyder of Yale University and a member of CIHR's Institute of Genetics Advisory Board, led an international research team that included CIHR-funded researchers Drs. Brenda Andrews, Richelle Sopko, and Michael Tyers, from the University of Toronto.
- Is genetic testing changing the way the medical system and patients view and interpret disease? This is among the questions being posed by Dr. Fiona Miller at McMaster University as part of research into the impact of genetics research on the medical system. Traditional diagnosis is based on observation and tests. Early results suggest that genetic testing, which is still not that widespread, is being treated as just one of a number of diagnostic tools, not the definitive tool and, therefore, not changing the diagnostic landscape radically. The future use of DNA microarrays, however, may change this perspective. Microarrays can simultaneously test for numerous conditions, resulting in diagnoses that doctors may never have considered and possible surprises for both patients and doctors.

In the Pipeline... From Genes to Genomic Medicine

Each day we learn more about the genetic factors involved in the development of organisms, addressing key questions such as: how do cells know what to become? How do organs and tissues develop? What guides the development of key functions such as the ability to reproduce or the ability to transmit and respond to electrical signals being sent to the brain? Despite an increasing genetic understanding of these subjects, the impact on medical practice to date has been limited.

The From Genes to Genomic Medicine Initiative is a strategic research priority theme of CIHR's Institute of Genetics. One of the goals of the initiative is to address the increasing need to translate scientific advances in our understanding of basic developmental processes, genetics and genomics into medical practice. Five different research projects have received funding as part of this initiative, involving research teams from Montreal, Toronto and Vancouver. One such project, led by Drs. Peter Lansdorp and Richard Humphries, is studying blood-forming stem cells needed for the daily replacement of short-lived mature blood cells. The researchers are studying the role of an enzyme thought to be essential to the self-renewal process. The hope is to ultimately produce a therapy to help the body compensate in cases where a deficiency in this enzyme is preventing adequate replacement of blood cells.

The Researchers... Dr. Frédéric Charron – Helping to Mend Damaged Spinal Cords

Dr. Frédéric Charron, a CIHR-supported researcher at the Institut de recherches cliniques de Montréal, doesn't doubt for a moment the ingenuity of nature, its ability to create complex tools and its habitual reuse of these tools for different tasks. He relies on these qualities in pursuing research that, one day, may lead to new and novel ways of repairing the damage caused by spinal cord injuries.

So it was that, during post-doctoral studies at Stanford University, Dr. Charron, 2005 winner of the Peter Lougheed/CIHR New Investigator Award, came to work with a molecule named after a videogame character – Sonic Hedgehog (Shh).

This research helped define a new role for Shh, helping guide the growth of axons, long fibers that carry electrical nerve impulses from one neuron to another.

"It's far easier for nature to evolve or adapt something for another task, rather than developing completely novel guidance cues, plus new receptors for those cues plus new signalling pathways to be able to carry this information," Dr. Charron notes.

Axons need to know where to go and this is an epic journey. In humans, axons can grow to one metre in length as they migrate up the spinal cord to the brain, where they form connections. All the while, the presence of Shh, like some artificial light source, helps attract and guide the growing axon. Dr. Charron explains that this journey is broken up into a number of steps.

"The system doesn't try to go the whole distance at once. It moves from A to B, then from B to C, and so on. Each of these steps is what we call a choice point. At each choice point, the system resets itself and becomes responsive to a new molecule to attract the axon," he notes.

Information such as this is critical in helping understand what it will take to repair spinal cord injuries. For example, once a person reaches adulthood, the guidance cue molecules are no longer effective because other molecules are working to maintain the now mature nervous system.

"We hope that we can reproduce the normal steps that occur when the spinal cord is being developed and encourage therapies. It's not enough just to make spinal cord axons regrow; just like electrical wires, they also need to know where to go and to reconnect correctly," Dr. Charron comments.

"For my research, genetics is a fundamental tool for dissecting and understanding how molecular mechanisms work."



CIHR IRSC
2005-2006

Healthcare System

The CIHR Institute

CIHR's Institute for Health Services and Policy Research is helping the country meet the challenge of making high-quality healthcare available to all those who need it, while ensuring that Canada's healthcare system is strong and sustainable. It fosters debate on reconciling privacy concerns with access to data needed to facilitate health research in order to protect Canadians and promote their health.

About CIHR

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The Canadian Institutes of Health Research (CIHR) is the Government of Canada's agency for health research. Through CIHR, the Government of Canada invested approximately \$28.9 million in 2005-06 in research on Canada's healthcare system.

The Facts

- In 2005, Canada was forecast to spend \$142 billion on healthcare, an average of \$4,411 per Canadian, a 6.9% increase over 2004.
- In 2005, spending was expected to increase to 10.4% of the gross domestic product.
- Hospitals remain the single largest category of spending, accounting for almost 30% of total spending. In 2005, spending was forecast at \$42.4 billion, up 6.4% from 2004.
- Drug expenditures continued to be the fast-growing category of health spending. Spending for 2005 was estimated to be \$24.8 billion, compared to \$16.7 billion five years before.
- In 2005, Canada was forecast to spend \$18.2 billion on physician services, up 6.4% from 2004.
- Private-sector health spending (insurance and out-of-pocket expenditures) was expected to increase to \$43.2 billion in 2005. Most private-sector spending was expected to go to drugs and dentistry.
- Public-sector spending on healthcare was expected to reach \$98.8 billion by the end of 2005.

Research Finding Healthcare Solutions

- CIHR, in partnership with the provincial and territorial Ministries of Health, funded eight Canadian research teams to examine wait times in the areas of cancer, joint replacement and sight restoration. The teams synthesized Canadian and international evidence from the best available research studies to help answer two questions: (1) What does existing research say about the relationship between clinical condition, wait times and health outcomes or quality of life for individuals waiting for treatment? and (2) What are the national or international wait time benchmarks (proposed or in use) for treatment, and what research evidence (if any) are they based on? The research helped inform the development of the first evidence-based benchmarks, which were announced in December 2005, and identified key gaps where further research is needed.
- Prescription drugs are the fastest-growing category of healthcare spending in Canada. A recent study by CIHR-funded researcher Dr. Steve Morgan at the University of British Columbia gives, for the first time, an accurate picture of how drugs are being used across Canada. The Canadian Rx Atlas highlights differences in drug use in different parts of the country and breaks down the factors that drive drug spending. The Atlas will be useful to provincial and territorial health officials across Canada as they face the complex problem of how to control rising prescription drug costs.
- According to a CIHR-supported study led by Dr. Marilyn Hodgins of the University of New Brunswick, patients in the province do not automatically head to the emergency room when they have a non-life-threatening illness. The survey of close to 2,000 New Brunswickers found that 74% tried to treat themselves first. Why do they go to the emergency department at all? Respondents cited fear that the condition might get worse; advice from others; and the lack of other options for dealing with the problem. Information such as this about New Brunswickers' use of healthcare services will help develop cost-effective and quality services that respond to people's healthcare needs.

- Is prenatal screening becoming as routine as a blood test? Is prenatal screening being presented as the responsible choice for the health of the baby? CIHR-supported researcher Dr. Brenda Wilson at the University of Ottawa suggests that some women are not making fully informed choices about these sorts of tests. As a consequence, more effort should be made to identify ways in which the healthcare system can promote informed decision-making. This might include training healthcare workers to provide better counselling to pregnant women, so that the personal ramifications of prenatal testing are considered just as much as the technical procedures.

In the Pipeline... Improving Services for Rural Residents with Alzheimer's Disease

Dr. Debra Morgan of the University of Saskatchewan is leading a New Emerging Team studying how to improve services for people with Alzheimer's disease who live in rural or remote areas. Research is ongoing but, so far, the team has designed, implemented and evaluated a memory clinic. The goal was to improve access to assessment, diagnosis and management of early-stage dementia. Seniors from rural and northern communities can now access streamlined one-day assessments at a centre in Saskatoon. Video conferencing or telehealth is used before and after the clinic assessment for pre-assessment and follow-up.

The Researchers... Dr. Heather Boon – Helping Define Modern Pharmacy Practice

The earliest pharmacists were persons skilled with knowledge of plants and herbs. With the rise of modern medicine and drugs based on synthesis of chemical compounds, attention to and knowledge of these earlier practices diminished. Today, however, such natural health products (NHPs) are very much part of the landscape of the modern pharmacy. The question is, are pharmacists ready and able to deal with this change? According to CIHR-supported researcher Dr. Heather Boon, the answer varies widely.

“Pharmacists get lots of questions from consumers seeking advice and information about natural health products. While some of them are able to answer these questions, there's also frustration among others that they don't have the answers. There are also big questions about whether NHPs are really part of pharmacy practice,” she notes.

Dr. Boon is helping pharmacists address these questions.

As part of a new research project, Dr. Boon and her team will be investigating attitudes and opinions about the role of the pharmacists in dealing with the now widespread use of NHPs, a category that includes everything from herbal remedies and homeopathy to vitamins and minerals. All told, there are more than 50,000 such products currently on the market.

The research team will seek input from pharmacists through one-on-one interviews and focus groups and through literature reviews. The team is also seeking input from doctors, the NHP industry, natural medicine practitioners and, most importantly, consumers themselves.

“We're very interested in what consumers are saying, since they are the ones who are driving the change and everyone else has been trying to play catch up,” Dr. Boon says.

“At the end of this project, we will have some very concrete and useful information that can be used to change both the regulation and practice standards for pharmacists and also influence education policies to make sure that pharmacists get the training they need in this area,” she says.

“Above all, we want to remove some of the variability that exists right now with the handling of natural health products across Canada, and what consumers can expect to be able to learn from pharmacists.”



CIHR IRSC
2005-2006

Heart Disease

The CIHR Institute

Heart, lung and blood vessel diseases are the major health burdens facing Canadians - yet if we understood how our genes, the environment, and our behaviour interplay to cause these common conditions, they might be preventable. CIHR's Institute of Circulatory and Respiratory Health is supporting research that asks tough questions about the causes, consequences, and control of these conditions.

About CIHR

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The Canadian Institutes of Health Research (CIHR) is the Government of Canada's agency for health research. Through CIHR, the Government of Canada invested approximately \$100.2 million in 2005-06 in research on cardiovascular diseases across Canada.

The Facts

- Cardiovascular disease is the leading cause of death in Canada and accounted for at least 33% of all deaths (34% among women, 32% among men) in 2002.
- Men are more likely to develop heart disease early in life; women tend to "catch up" around menopause. Women experiencing heart disease or stroke are often under-diagnosed or managed differently than men.
- According to the 2003 Canadian Community Health Survey conducted among persons aged 12 years or more, five million Canadians say they are affected by heart disease, hypertension and stroke.
- Cardiovascular disease is the most costly disease affecting Canadians. In 1998, it was responsible for \$18.5 billion in expenditures, or 11.6% of the total cost of all illnesses in Canada. Of this, \$6.8 billion was in direct costs, particularly for hospital care, and \$11.7 billion was in indirect costs, most due to premature death.

Research Finding Solutions to Heart Disease

- CIHR-supported researcher Dr. James Christenson, of BC's Providence Health Care developed a test for identifying the severity of chest pains that will help reduce emergency department overcrowding. The Vancouver Chest Pain Rule helps determine which chest pain patients can be safely sent home sooner, thereby reducing the need for prolonged emergency room observation, extensive rule-out protocols and expensive testing.
- E-mail is a source of constant aggravation for many people – but it can also be a source of health according to CIHR-funded researcher Dr. Ronald Plotnikoff of the University of Alberta. He has shown that sending regular health-promotion e-mails can have an impact on reducing some of the risk factors for heart disease, such as being overweight and not eating enough fruits and vegetables. In a study involving 1,600 participants in five large Canadian workplaces, half received a series of e-mails (one per week for a period of 12 weeks) promoting the benefits of healthy eating and exercise. At the end of the study, the group receiving e-mails actually showed a small decrease in their Body Mass Index (BMI), while those with empty mailboxes saw their BMI go up.
- Hardened arteries, a condition known as atherosclerosis, are a major cause of heart disease and stroke. CIHR-funded researcher Dr. Richard Austin of McMaster University has discovered more about the role of one of the chemicals produced by the body that accelerates atherosclerosis. Dr. Austin demonstrated that the chemical, called peroxynitrate, activates a kind of stress response in cells, which causes inflammation and changes in the way the cells metabolize fats, both of which contribute to changes in arteries. Dr. Austin is now working to find ways to block this stress response, which will be another tool in the fight against heart disease.
- CIHR-supported researcher Dr. Janos Filep of the Université de Montréal discovered a new role for the C-reactive protein (CRP) in coronary heart disease. Previous research established CRP as a sign of inflammation. New research by Dr. Filep determined that a

modified form of this protein helps stimulate production of white blood cells, which accelerates inflammation in the coronary arteries and contribute to heart disease. The research suggests that blocking this protein could be a new way of treating heart disease.

- High-risk heart failure patients are the least likely to be given drugs meant to prevent the condition, according to a study by CIHR-supported researcher Dr. Douglas Lee of the Toronto-based Institute for Clinical Evaluative Sciences. The study examined 1,418 heart failure patients aged 79 and younger discharged from hospital after treatment for a heart failure. Paradoxically, patients identified as low-risk were 61% more likely to receive drugs that prevent blood vessels from constricting, allowing blood to flow more freely to the heart than high-risk patients. The study provides new information that will help reinforce drug usage guidelines for heart failure patients.

In the Pipeline... Studying Gender Differences in Heart Disease

Dr. Louise Pilote of McGill University is leading a five-year project studying gender differences in heart disease. One such difference is that women are more likely than men to die in the first year after a heart attack. Another is the higher mortality rate among diabetic women with heart disease compared to diabetic men. Historically, the majority of research on heart disease has focused on men, making it difficult to get an accurate picture of how the disease affects women. The research team includes 30 investigators from across Canada. Research will help build improved treatment for heart disease that takes key gender differences into account.

The Researchers... Dr. Jeffrey Wigle – Helping Damaged Hearts and Preventing Heart Disease

For Dr. Jeffrey Wigle, every day at work offers a chance at discovery, a thrill, he says, that has never worn off since the first time he published new and novel information. “There’s this incredible feeling when you show something that no one has never seen before and describe what it looks like and what it does – it’s the joy of discovery.”

After completing post-doctoral training in the United States, Dr. Wigle came back to Canada thanks to the availability of new funding from sources such as CIHR. Since that time, he’s worked as a researcher at the University of Manitoba’s Institute of Cardiovascular Sciences at the St. Boniface General Hospital Research Centre.

Dr. Wigle is studying the function of two genes, known as Meox1 and Meox2 that play a key role in the growth of smooth muscle cells found in both blood vessels and the heart muscle.

Dr. Wigle wants to use the genes to encourage the growth of new heart muscle cells which are damaged when heart attacks occur. He also wants to intervene before heart disease can take hold. For example, too much growth of smooth muscle cells in blood vessels leads to blocked arteries, a condition known as atherosclerosis. Excess growth also happens as a result of operations meant to reverse the impact of clogged arteries, such as bypass surgery or balloon angioplasty.

“The body treats this as an injury and, in this case, there is decreased expression or production of the Meox proteins (produced by the Meox genes) which, until that point, have acted like a brake on cell growth. With the brake suddenly removed, there is an excess growth of cells,” he notes.

For Dr. Wigle, even though the function of these proteins is well documented, more research is needed to understand the genetic changes responsible for increasing or decreasing production of the Meox proteins.

According to Dr. Wigle, learning more about these detailed processes is essential to designing new and highly targeted drugs for patients. “We want to make sure that we are creating new therapies that are precisely tailored for the job they need to do,” he notes.



CIHR IRSC
2005-2006

HIV/AIDS

The CIHR Institute

CIHR's Institute of Infection and Immunity leads CIHR's efforts in the fight against HIV/AIDS. It manages the research arm of the Federal Initiative to Address HIV/AIDS in Canada. With the assistance of the CIHR HIV/AIDS Research Advisory Committee, the Institute is identifying research priorities and undertaking collaborative research initiatives to reduce the burden of HIV/AIDS domestically and internationally.

About CIHR

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The Canadian Institutes of Health Research (CIHR) is the Government of Canada's agency for health research. Through CIHR, the Government of Canada invested approximately \$36 million in 2005-06 in research on HIV/AIDS across Canada.

The Facts

- Human immunodeficiency virus (HIV) is the virus that causes acquired immunodeficiency syndrome (AIDS). The virus mutates rapidly, creating new strains that make it hard to detect, prevent and treat. While treatments exist, they are costly and not readily available in developing countries. There is no cure for AIDS.
- The HIV virus is transmitted by the transfer of blood and semen through such activities as sexual intercourse and the sharing of needles. It can also be transmitted by infected mothers who breastfeed their infants.
- The first case of AIDS in Canada was reported in 1982. By December 31, 2005, there were a total of 60,160 positive HIV test reports in Canada.
- In 2005, around four million adults and children became infected with HIV worldwide. By the end of the year, an estimated 38.6 million people were living with HIV/AIDS. The year also saw almost three million deaths from AIDS. More than 95% of new HIV infections were in low- and middle-income countries.
- Women accounted for half of all new HIV infections among adults over the age of 15 worldwide in 2005. In Canada, women accounted for one quarter of positive HIV test reports, an increase from the period before 1996, when they accounted for just 10% of such tests.
- In 2003, 14.4% of Canadian AIDS cases with known ethnicity were Aboriginal people. Compared to the general population, Aboriginal people who test positive for HIV are more likely to be female, under 30 and have been infected through injection drug use. A high proportion of HIV-infected pregnant women are Aboriginal.

Research Finding Solutions to HIV/AIDS

- CIHR-funded researchers at Toronto's Hospital for Sick Children, University of Toronto, led by Dr. Clifford Lingwood, have found a novel molecule that prevents many types of HIV, even drug-resistant strains, from infecting different kinds of cells. The molecule binds to the virus and prevents it from fusing with the host cell. The molecule is soluble, making it particularly promising for use in a topical microbicide that women can apply before intercourse to prevent transmission of the virus.
- A CIHR-funded researcher from the Université de Montréal, Dr. Louis de Repentigny has identified defects in immune cells that give rise to a fungal infection commonly found in HIV patients called candidiasis. The infection can limit food consumption, leading to weight loss, which threatens patients' general health and well-being. The infection is often resistant to conventional antifungal treatments. The new knowledge will help in the development of more powerful and effective treatments for the fungal infection.
- CIHR-funded researcher Dr. Mario Ostrowski at the University of Toronto is using state-of-the-art techniques in immunology and virology to design a new, improved version of an HIV vaccine made from the canarypox virus. Clinical testing of an earlier version of the vaccine found it did not create a strong enough immune response to be effective. Once the new vaccine is developed, it will be tested in mice and monkeys and, if successful, it will move on to clinical testing in humans.

- For many HIV patients, staying healthy means adhering to one's drug treatment therapy. A positive attitude toward taking medication and a strong sense of self-efficacy were the most significant predictors of adherence to antiretroviral therapy, according to a study out of Université Laval. Led by CIHR-funded researcher Dr. Gaston Godin the study also found that not living alone and being a male were other predictors of success. Information such as this is important in designing programs that can be used to improve adherence to treatment programs.
- Working with a group of HIV-resistant female commercial sex workers in Nairobi, Kenya, CIHR-funded researcher Dr. Keith Fowke of the University of Manitoba was part of a team that has found that women who are resistant to HIV respond differently to a peptide called p24, which could result in a longer lifespan for a group of immune response cells known as CD4+T cells. This information will be valuable in designing and developing an effective HIV vaccine.
- People who are exposed to HIV without becoming infected are more likely to have immune responses to HIV than those who are at low risk for exposure, according to research by CIHR-funded researcher Dr. Nicole Bernard of McGill University. These immune responses appeared to protect the uninfected people exposed to HIV from infection, regardless of whether their exposure to the virus came through injection drug use or sexual behaviour.

In the Pipeline... Getting the Needed Treatment

Anyone in British Columbia infected with HIV can receive medication at no cost – but many people aren't getting the drugs they need to stay alive. In 2003, one third of people who died of HIV-related causes did not receive treatment – many of them residents of Vancouver's Downtown Eastside, known for its high population of injection drug users (IDUs). The lowest life expectancy for HIV-positive individuals in the province is among IDUs not receiving anti-HIV treatment. It is believed that 35% of the city's estimated 15,000 IDUs are currently infected with HIV.

Dr. Thomas Kerr of the B.C. Centre for Excellence in HIV/AIDS wants to improve access to HIV treatment for these people, by examining the barriers they face to gaining access to treatment. He will examine the influence of law enforcement, addiction treatment levels and psychological variables, as well as socio-economic issues such as unstable housing, on access and adherence to treatment. His work could lead to the development of more effective interventions targeting this high-risk population.

The Researchers... Dr. Julio Montaner – Exemplifying Excellence

Twenty years ago, men started showing up at St. Paul's Hospital emergency room in Vancouver with fatal pneumonia. No one knew what it was. All that was known was that the men were young, previously healthy – and gay.

These were among the earliest victims of AIDS. In the past 20 years, AIDS has dramatically been transformed from a lethal epidemic into a chronic and manageable condition with highly active antiretroviral therapy (HAART).

Dr. Julio Montaner was at the forefront of that transformation. He has been involved with HIV/AIDS clinical trials for more than 20 years. He is widely acknowledged as one of the fathers of modern HAART. He has also published hundreds of research papers and was the first to report that antiretroviral therapy can be started later than previously believed without adverse effects on the patient. His current research focuses on developing and testing new treatments for people who are not responding to the standard antiretroviral therapy and new strategies to curb the growth of the epidemic. And now he is poised to become President-Elect of the International AIDS Society in August 2006.

Dr. Montaner received his training in Argentina, coming to Canada in 1981 as a postdoctoral fellow at St. Paul's Hospital and the University of British Columbia. The benefits of conducting research in Canada keep him here. Among them is Canada's public healthcare system, which means that there is a standard of care to which all people with HIV/AIDS have access. As a result, he can focus on the more difficult questions, such as why some patients don't respond to antiretroviral therapy and how to reduce its side effects. Another pressing issue involves how to reach populations, such as Aboriginal injection drug users, who do not tend to receive treatment to the same degree as others infected with HIV. The Canadian HIV Trials Network provides an integrated approach that reinforces Canada's strengths in HIV/AIDS clinical trials.

Dr. Montaner is a fierce advocate for his patients, recently expressing his "moral outrage" that Health Canada had approved more than 21,000 requests for banned silicone breast implants while continuing to deny patients with advanced HIV access to potentially life-saving drugs.

Now, Dr. Montaner would like to see Canada take its leadership role in preventing, treating and managing HIV/AIDS into the international arena. Canadian researchers, he says, can help to translate our achievements into global advances, and help end the devastation that HIV/AIDS is causing throughout so much of the world.

The CIHR Institute

CIHR's Institute of Infection and Immunity supports research and helps to build research capacity in the areas of infectious disease and the body's immune system. Through the Institute's programs, researchers address a wide range of health concerns related to infection and immunity including disease mechanisms, disease prevention and treatment, and health promotion through public policy.

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The Canadian Institutes of Health Research (CIHR) is the Government of Canada's agency for health research. Through CIHR, the Government of Canada invested approximately \$167.1 million in 2005-06 across Canada in research on infectious diseases.

The Facts

- There were 207 confirmed cases of avian influenza in humans between January 28, 2004 and May 8, 2006, as the infection spread to locations such as Turkey and Egypt. Of the 207 cases, 115 resulted in deaths. Most cases are the result of bird-to-human infection; however, human-to-human transmission has been suggested in at least one case. The virus's ability to turn into a pandemic is being closely monitored.
- A flu pandemic could infect 15-35% of the Canadian population, causing up to 50,000 deaths, according to estimates by the Public Health Agency of Canada. A vaccine or antiviral drugs would reduce both illness and deaths.
- The first recorded outbreak of West Nile virus in North America happened in New York City in 1999. The first reports of the virus in Canada came in August 2001 and the first confirmed human cases in 2002. West Nile virus has been found across Canada. It usually causes no symptoms or mild flu-like symptoms. It can, however, cause serious illness requiring hospitalization and, in some cases, death.
- Bovine spongiform encephalopathy (BSE) in cattle has been linked to variant Creutzfeldt-Jakob disease (vCJD) in humans. Despite three cases of BSE in Canada, there have been no cases of vCJD here to date. The disease is one of a small group of fatal diseases called prion diseases, in which infectious agents called prions (or misfolded proteins) attack the brain, killing cells and creating gaps in tissue.
- Between 1995 and 2003, rates of multi-drug resistant *Staphylococcus aureus* (MRSA) in Canadian hospitals increased from about 0.5 cases per 1,000 admissions to 5 per 1,000 admissions. MRSA is making many antibiotics obsolete and is a threat to our ability to control bacterial infection.

Research Finding Solutions to Infectious Diseases

- Drs. Heinz Feldmann (University of Manitoba) and Steven Jones (B.C. Cancer Research Agency), two researchers funded by CIHR in collaboration with international colleagues, have developed vaccines that have shown tremendous promise in providing protection against Ebola, Marburg and Lassa viruses in monkeys. The next step is to test the vaccines on humans to see if they stimulate a similarly strong immune response. This research could translate into effective treatment for humans – and spell relief for healthcare workers on the frontline fighting these infectious diseases.
- Years after the outbreak of stomach infections and deaths caused by an *E. coli*-infected water supply in Walkerton, Ontario, the effects of the outbreak are still being felt. A study of almost 2,000 area residents found that 27% of those who had no symptoms at the time of the outbreak have since been diagnosed with hypertension. This figure climbs to 35% among people who had severe symptoms of gastroenteritis. Roughly the same percentage of respondents also suffered from reduced kidney function. CIHR-supported researcher Dr. Amit Garg of the London Health Sciences Centre is the principal author of the study.
- According to research by CIHR-funded Dr. Gerard Wright of McMaster University, microbes found in soil have incredible resistance to antibiotic drugs. Dr. Wright collected 480 samples and found that each and every one was resistant to at least seven or eight antimicrobial agents. The study raises concern that such resistance mechanisms can be and are being transferred to existing bacterial pathogens affecting humans, creating superbugs resistant to new antibiotics.

- A research team from the University of Saskatchewan has developed a possible vaccine for hepatitis C, an illness that affects some 170 million people worldwide. The team, led by CIHR-funded researcher Dr. Sylvia van den Hurk, demonstrated that, by harvesting certain immune cells from mice, exposing them to one of the proteins in the virus that causes hepatitis C and then putting them back into the body, these cells were able to “teach” other immune cells to create an immune response. The vaccine is also unique because it helps reduce the amount of virus in people already infected and, in doing so, helps spare severe damage to the liver caused by the virus.
- A team led by CIHR-funded researcher Dr. Natalie Strynadka of the University of British Columbia has, for the first time, been able to describe the exact structure of a multi-protein “machine” responsible for making many bacterial pathogens dangerous. This machine allows such pathogens to “inject” bacterial proteins into human cells. By better understanding its structure, researchers can hope to design new drugs to prevent harmful proteins from entering human cells.

In the Pipeline... Safer Water Supplies

Dr. Marie Louie from Sunnybrook and Women’s College Health Sciences Centre is leading a project investigating just how many of the bacteria in the water supply are resistant to antibiotics as a result of widespread use of such agents in agriculture and livestock farming. Preliminary data from testing of private and recreational water sources in Alberta and southern Ontario indicate that such bacteria are indeed present. The next step is to merge this data with other information about land use as well as soil types and geology. Eventually, using such information, public health officials will be able to identify and focus on the areas that have a high risk of well-water contamination with antibiotic-resistant *E. coli*.

The Researchers... Dr. Fiona Brinkman – Looking for Answers in a Sea of Bacteria

Humans think of themselves as masters in their own house but, according to Dr. Fiona Brinkman at Simon Fraser University in Vancouver, this perception may not be 100% accurate.

As it turns out, humans have a kind of joint occupancy agreement with bacteria; although much smaller in size, bacterial cells outnumber human cells in the order of ten to one.

“This is not at all bad. The presence of this flora really helps,” Dr. Brinkman says. Such bacteria play an important role in digesting food and stimulating our immune system. They literally take up space that, left unoccupied, could be “colonized” by more harmful forms of bacteria, known as pathogens. With this in mind, she is particularly concerned about the use of antibiotics, which, in killing the harmful bugs, also wipes out large numbers of “good” bacteria.

“In the best case scenario, we would like to target pathogens more specifically – preferably destroying their toxins and other factors that specifically cause disease, putting pressure on them to convert into non-pathogens,” she observes.

Her lab is studying the best ways to do this. For Dr. Brinkman, this involves improving our understanding of how bacteria evolve and when they cross the line from harmless to pathogenic. Part of the answer lies in the concept of “genomic islands” – as bacteria evolve and mutate, they can acquire genetic traits from other bacteria and bacterial “viruses”. Horizontal transfer is often the source of genes that make a bacterium more virulent.

With CIHR funding, Dr. Brinkman is building improved computer software tools to analyze these islands and identify the genes causing virulence. Dr. Brinkman is enthusiastic that, with more accurate analysis of bacteria, new therapies are within reach.

“We know the genetic sequence of over 300 different bacteria. There are great discoveries just sitting there in the DNA,” she concludes.



CIHR IRSC
2005-2006

Mental Health

The CIHR Institute

From diseases of the central nervous system, such as multiple sclerosis, to addiction, to mental illnesses such as schizophrenia, to pain and the five senses with which we interpret the world, CIHR's Institute for Neurosciences, Mental Health and Addiction is concerned with how the brain works and how to deal with the social stigmas associated with mental illness.

About CIHR

The Canadian Institutes of Health Research (CIHR) is the Government of Canada's agency for health research. CIHR's mission is to create new scientific knowledge and to catalyze its translation into improved health, more effective health services and products, and a strengthened Canadian healthcare system. Composed of 13 Institutes, CIHR provides leadership and support to more than 10,000 health researchers and trainees across Canada.

The Canadian Institutes of Health Research (CIHR) is the Government of Canada's agency for health research. Through CIHR, the Government of Canada invested approximately \$47.5 million in 2005-06 in research on mental health and addiction across Canada.

The Facts

- Mental illness is a broad classification for several disorders, including anxiety, depression, schizophrenia, personality disorders and eating disorders.
- One out of every five Canadians will have a mental health problem at some point in his or her life.
- The onset of most mental illness occurs during childhood, adolescence and young adulthood.
- One in 100 Canadians suffers from schizophrenia and another one in 100 suffers from bipolar disorder, or manic depression; 8% of adults will experience major depression at some point in their lives, while 12% of the population is affected by anxiety disorders.
- Schizophrenia, depression, and bipolar disorder are together responsible for more than 20% of years lived with a disability in established market economies.
- About 3% of women will be affected by an eating disorder during their lifetime.
- As a group, people with mental illness are more likely to be victims of violence than to be violent themselves.
- Lost productivity from poor mental health is estimated to cost Canadian businesses \$33 billion per year.

Research Finding Mental Health Solutions

- Addiction to drugs involves powerful forces in the brain. CIHR-funded researchers Drs. Anthony Phillips and Yu Tian Wang of the University of British Columbia have demonstrated how to prevent the brain from remembering previous pleasurable responses to stimulant drugs such as cocaine. The team created a protein fragment (a peptide) that it used to block the chemical communications between brain cells that are necessary for recalling these memories. Their work could result in new treatments for addiction.
- An international team led by CIHR-supported researcher Dr. Xia Zhang at the University of Saskatchewan has discovered an enzyme known as PTEN that stimulates receptors for serotonin. This, in turn, increases brain activity in a way similar to the "rewards" produced by drug abuse. The team has been able to develop a peptide to block PTEN from reacting with the receptors. Their work raises the possibility for developing future therapies to prevent addiction.
- CIHR-supported researcher Dr. Min Zhou of the University of Toronto, along with colleagues from South Korea and China, reported on where painful memories become stored in the brain and how this process occurs, a finding that points to possible therapies for helping control fears and post-traumatic stress. A group of receptors known as NMDA receives information in response to a painful event, which then affects brain cells located in a region at the front of the brain known as the amygdala. When this activity is repeated over time, the process physically alters these brain cells. In experiments with mice, when researchers blocked a protein associated with these receptors, the mice no longer avoided an obstacle previously associated with fear.

- Double trouble. It's not just the name of a classic board game. It also describes overlapping problems with mental health and addiction. A recent study by CIHR-supported researchers Drs. Saulo Castel and Brian Rush of Toronto's Centre for Addiction and Mental Health found that, among clients of an outpatient addictions treatment program, 25% had 3 or more different mental health problems. The results suggest there should be routine screening for mental disorders as part of counselling for addiction, information which can help improve the treatment plan – and outcomes – for patients.

In the Pipeline... Addressing Mental Illness Among Canada's Peacekeepers

Canada has a long-standing reputation for sending peacekeepers where they are needed most, but what happens when the peacekeepers are the ones who need help? A team of researchers lead by Dr. Jitender Sareen of the University of Manitoba is receiving funding from CIHR to study data collected as part of a mental health survey of military personnel, the largest ever undertaken. Using this survey data, the team is identifying the risk factors for mental illness and post traumatic stress among peacekeepers. The team is also using this information to assess whether soldiers' mental health needs are being met and to identify barriers to obtaining treatment and the kinds of treatments needed. The results of this research could ultimately affect policy for mental health services in the armed forces.

The Researchers... Dr. Karim Nader – Helping Manage Painful Memories

At 39, Dr. Karim Nader of McGill University is young by most standards, but what he's accomplished has set him ahead of many others his age.

In 2000, he published a paper in the prestigious journal *Nature* that challenged a 100-year old theory about how long-term memories are formed and stored.

Cellular memory consolidation refers to a process where new memories in short-term memory become stabilized and transfer into long-term memory. The process, which takes place over the space of about six hours, involves the creation of specific RNA and proteins in the brain essential in helping consolidate the memory.

"In the old system, a memory was like some kind of card catalogue system. Memories, once consolidated, stayed fixed in the brain and could be retrieved any number of times without changing," Dr. Nader explains. His research findings, however, introduced a concept completely at odds with the existing model – changeability.

Ironically, similar findings had first been noted in the early 1970s but failed to generate the attention they deserved at the time. They languished, forgotten, until Dr. Nader found them years later, while validating his own research results in this area.

Research by Dr. Nader demonstrates that, when previously consolidated memories are recalled, they enter into a state similar to short-term memory, becoming "labile" and subject to alteration. In this scenario, instead of a card printed with indelible ink, one has something more like an Etch-A-Sketch; any lines on the sketch tablet can be modified. Likewise, during the reconsolidation of memory, changes are possible.

"Just because a memory becomes labile again does not necessarily equal wiping it out or degrading it. Reconsolidation can also strengthen memory," he notes.

What continues to draw attention from a therapeutic point of view is the possibility that memories of trauma can be weakened by interrupting the reconsolidation process. In fact, Dr. Nader is currently collaborating with Drs. Alain Brunet (McGill), Scott Orr (Harvard) and Roger Pitman (Harvard) to see if they can treat patients who are suffering from post-traumatic stress disorder (PTSD) by targeting the reconsolidation of their traumatic memory. But he is very clear that they are only trying to turn down the intensity of the memory while it undergoes reconsolidation and not affect the content of the memory.



CIHR IRSC
2005-2006

Obesity

The CIHR Institute

Obesity is not rocket science, says Dr. Diane Finegood, Scientific Director of CIHR's Institute of Nutrition, Metabolism and Diabetes - it's more complex. That's why, after extensive consultation with stakeholders, the Institute declared its primary priority to be the growing problem of obesity and the maintenance of a healthy body weight, an issue that cuts across all areas of its mandate. INMD is mandated to support research to enhance health in relation to diet, digestion, excretion and metabolism.

About CIHR

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The Canadian Institutes of Health Research (CIHR) is the Government of Canada's agency for health research. Through CIHR, the Government of Canada invested approximately \$19.9 million in 2005-06 in research on obesity across Canada.

The Facts

- In 2004, 23% of Canadian adults were considered obese, with a body mass index (BMI) of more than 30, compared to just 14% in 1978. One in four seniors over the age of 75 was obese.
- One-quarter of Canadians who were overweight in 1994-95 had become obese by 2002-03; only 10% had returned to a healthy weight.
- Deaths attributable to complications of overweight and obesity nearly doubled between 1985 and 2000.
- In 2004, 18% of children aged 2 to 17 were overweight and 8% were obese – together accounting for more than one-quarter of all children.
- Obesity is a risk factor for heart disease, stroke, type 2 diabetes, gallbladder disease and some forms of cancer. It has also been associated with hypertension (high blood pressure), osteoarthritis and sleep disorders such as sleep apnea.
- The health costs of obesity, including hospital care, physician services and drugs, were estimated to be more than \$4.3 billion in 2001, or 2.2% of total healthcare expenditures for all diseases in that year.
- The World Health Organization has identified obesity as the major neglected public health issue.

Research Finding Solutions to Obesity

- Obesity is a well-established risk factor for heart disease – but there is little agreement on the best way to measure obesity to determine the true risk. For example, obesity is commonly defined in terms of Body Mass Index (BMI). But the BMI has had only varying success as a measurement for the risk of a heart attack. In separate studies, CIHR-supported researchers Drs. Salim Yusuf (McMaster University), Jean Després (Université de Montréal) and Peter Katzmarzyk (Queen's University) have all compared waist-to-hip ratio and BMI as risk predictors of cardiovascular disease. All reported the superiority of waist-to-hip ratios, particularly for some ethnic populations. Their findings will allow healthcare professionals to predict the risk of heart attacks with greater accuracy.
- Having difficulty saying no to food is not just a matter of poor self control; it may have genetic causes as well. CIHR-funded researcher Dr. Louis Pérusse at Université Laval has identified a gene linked to eating behaviours and obesity. A mutated version of the gene is related to a lowered ability to stop eating, as well as a susceptibility to hunger. Over a six-year period, people with the mutation gained more than twice as much body fat as people without the mutation.
- Having poor eating habits now does not mean having them for life, especially if you're living with someone who makes healthy food choices. CIHR-funded researcher Dr. Gwen Chapman at the University of British Columbia researched the possibility that healthy eating habits can be shared or improved in a cohabitation relationship. By recording food journals and interviews, Dr. Chapman found that, as time progressed, the partner with the healthier eating habits was able to influence the eating habits of the other partner. Dietitians can use this information to better direct and encourage changes in the eating habits of their clientele.

- New CIHR-funded research by Dr. Meizi He at The University of Western Ontario suggests that parents concerned about television viewing habits should worry less about the content their children are watching and more about the amount of time spent in front of the television set. Dr. He surveyed the parents of children from 2 to 5 years in age about parental concerns with regards to television. She found that most parents were not concerned with the amount of time spent watching, but rather the content.

In the Pipeline... Targeting Obesity

Premenopausal and post-menopausal women are at different stages in their lives, but face many of the same challenges when it comes to weight.

For premenopausal women, too much attention to weight could cause fertility problems and bone loss. Chronic dieting increases the likelihood of disturbances in menstrual cycles and results in higher levels of the stress hormone cortisol, which is linked to bone loss. Dr. Susan Barr at the University of British Columbia will be studying both premenopausal and postmenopausal women to learn more about the possible health risks of excessive dieting.

Two-thirds of post-menopausal women, meanwhile, are overweight. Menopause may trigger metabolic and behavioral changes that increase the risk of obesity and associated problems. A CIHR-funded multidisciplinary research team from the Universities of Montreal and Ottawa, led by University of Ottawa researcher Dr. Denis Prud'homme, are studying the physiological, behavioural and biomechanical factors underlying weight gain, weight loss and weight regain in women during and after menopause.

The Researchers... Dr. Guang Sun – Searching for the Causes of Childhood Obesity

Dr. Guang Sun of Memorial University in Newfoundland and Labrador has established a track record in studying the problem of adult obesity. He's now applying this expertise as part of a CIHR-supported pilot project on childhood obesity.

"I consider obesity as a disease, and we need to keep raising awareness. It's not a question of body image. With obesity, there's a long-term risk of developing other serious disorders," Dr. Sun notes.

According to Dr. Sun, there are as many as 600 genes that could be linked to obesity; such genes can affect appetite and overall metabolism or regulate the way fat is stored in the body. Of the 600, seven have been selected for the present study of childhood obesity.

"With this study, we will be recruiting 100 families where there are one or more children who are obese," Dr. Sun notes. The team will be taking genetic samples from participants and screening them to see which of the seven genes are present.

Newfoundland and Labrador enjoys a somewhat unique status in the world of genetics research because, similar to Iceland or the Lac Saint-Jean region of Quebec, the population shares a somewhat homogenous genetic profile. This makes it easier to spot the obesity genes, and makes it easier to analyze and compare the family histories of people with these genes.

The project is also unique in the way in which it's linking data from genetic testing to physical testing. Participants will be scanned using an instrument originally developed for measuring osteoporosis, a bone densitometer. The scan measures not only the quantity of fat but also the location of this fat, since not all types of fat are equal.

"Central body fat is far more harmful than lower body fat," Dr. Sun notes. "With this technique, we get much more focused information that we can use to accurately measure the genetic effect."

The plan is to expand the pilot into a larger study involving 300 children and then to design gene chips for even faster screening.

"It's a first," Dr. Sun says of the study.

The CIHR Institute

What makes some people healthy while others suffer from disease or disability? The reasons can vary, from biological to cultural to social to environmental. CIHR's Institute of Population and Public Health is studying these factors as the basis for sound programs, preventive practices and healthy public policies that will improve the health of people in Canada and around the world.

About CIHR

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The Canadian Institutes of Health Research (CIHR) is the Government of Canada's agency for health research. Through CIHR, the Government of Canada invested approximately \$45.9 million in 2005-06 in research on population health issues across Canada.

The Facts

- Population health research takes a broad approach to understanding the fundamental determinants of human health at the individual, community and societal levels. Population health research focuses on protecting populations from hazards in the environment; preventing disease; and promoting health.
- Factors such as income and social status, education and literacy, employment, social support networks and social and physical environments are important determinants of health at the population level.
- Here are some examples of how these determinants can affect health:
 - Low birth weight infants are at increased risk for developing many diseases later in life, as well as for delays in development. Low birth weight children from privileged backgrounds, however, still have a developmental advantage over normal birth weight children from under-privileged backgrounds.
 - Smoking, obesity, high stress, low household income and low sense of community belonging all have significant negative effects on health status.
 - Recent immigrants from non-European countries were twice as likely as the Canadian-born to report deterioration in their health over an eight-year period (1994/95-2002/03), according to the National Population Health Survey, despite the fact they are generally in better health than the Canadian-born population when they arrive in Canada.
 - Families whose members are better-educated and have higher incomes eat a diet closer to nutritional guidelines than those with less education and lower incomes. Inadequate diet is linked to the development of many diseases.
 - Individuals who lack control over their work environment are more likely to develop and die from cardiovascular disease.

Research Promoting the Health of Populations

- Air pollution sends poorer children to hospital with asthma more often than it does children from more affluent homes, according to research by CIHR-funded investigators including Dr. Yue Chen of the University of Ottawa. The team was examining the effect of gaseous air pollutants such as carbon monoxide, sulphur dioxide, nitrogen dioxide and ozone. Exposure to nitrogen dioxide was most harmful to boys in low socio-economic groups, while sulphur dioxide was most harmful for girls from this group. The risk of asthma is higher for people from low socio-economic backgrounds.
- Increasing the share of income to the poorest half of households in metropolitan areas (MAs) in Canada, Australia, Great Britain, Sweden and the United States by one per cent can result in a decrease in working-age (25-64) mortality of more than 21 deaths per 100,000 people, according to research by CIHR-funded researcher Nancy Ross of McGill University. Her study found a significant relationship between inequality and mortality, however, only in MAs in the United States and Great Britain, the countries with the highest average levels of income inequality and the largest populations of the countries studied. The research suggests that the more egalitarian countries of Canada, Australia and Sweden buffer the hypothetical effects of income inequality as a determinant of population health in industrialized countries.

- As part of a CIHR-funded survey, University of Victoria sociologist Mikael Jansson has been studying the homeless youth population in Victoria, B.C. The most common reason for living on the street is family instability, the survey found. Almost all participants reported earning money by selling drugs; most also use drugs on a weekly basis, with 75% reporting using marijuana, 45% drinking alcohol and 20% using crystal meth. Only 7% had a paying job and, while most wanted a job, lack of an address, a phone and work clothing stood in their way. The project also highlighted the inherent challenges of research involving hard-to-reach or hidden populations. Dr. Jansson and his team have followed many of the youth over the past five years, and hope to continue for another five years.
- Living in resource-reliant rural communities is good for your health, according to residents of two such communities in Alberta. Dr. Judith Kulig of the University of Lethbridge studied the two communities, together with a third, urban community, to determine what makes communities resilient and whether there is a link between resiliency and health status. Participants in the study perceived their rural communities as healthy and believed that living in their communities enhanced their health. Social interactions were seen as essential to health, although participants also expressed concerns about environmental health issues.
- Eradicating extreme poverty is one of the United Nations' eight Millennium Development Goals. A CIHR-funded project led by Dr. Theresa Gyorkos of McGill University and Dr. Martin Casapia of the Asociación Civil Selva Amazónica and Universidad Nacional de la Amazonía Peruana has developed a list of the top ten issues of health importance to a small, poverty-stricken community in Peru, including infant malnutrition, adolescent pregnancy, anemia, parasite infections, and lack of basic sanitation. The team, working with community members, has also developed health, nutrition and education interventions to help improve health and, ultimately, reduce poverty. Dr. Gyorkos has now received five-year funding from CIHR to implement and evaluate selected interventions to address the priorities.

In the Pipeline... Designing Effective Interventions

How can cohesion and friendliness in neighbourhoods affect people's health? And how can you maximize factors that improve health? CIHR-funded researcher Dr. Penny Hawe of the University of Calgary is leading an international effort that focuses on the impact of social and physical environments on health. One of the first projects is focused on improving the social environments in high schools. Research from the World Health Organization has shown that alienation from school is the biggest predictor of health risks for youth, such as smoking, drinking or drug use.

The Researchers... Dr. Jean Shoveller – Passionate About Youth

Youth sexual health has usually been approached from the perspective of individuals' risky behaviour. But Dr. Jean Shoveller, an Associate Professor in the University of British Columbia's Department of Health Care and Epidemiology and a Scholar with the Michael Smith Foundation for Health Research, is taking a broader approach – and building key partnerships to turn her research into better health for youth.

"I'm more interested in understanding and addressing the structural factors that put young people at risk," she says. "We need to see more progress in this area. Young people deserve to have the opportunity to have positive experiences in relation to sexual health."

Much of her recent work has centred on understanding the experiences of young mothers in Prince George, British Columbia, in trying to continue their education, find adequate housing and employment, and enhance their parenting skills. Her partnerships with the Prince George School Board, teachers, social workers, the Northern Health Authority and, especially, the young mothers themselves have resulted in slow but steady progress in developing more and better options. She credits the commitment of community partners.

"They live it every day. What they do takes much more courage than being a researcher," she says.

Dr. Shoveller was recently awarded a CIHR Interdisciplinary Capacity Enhancement Team grant focusing on the impact of gender, culture and place on youth sexual health disparities in rural and northern communities – investigating how to transform structural forces in order to improve youth health and social well-being.

She also is excited about a pilot project funded by CIHR that is engaging youth as research partners, not merely the subjects of the research. The project is developing tools to enable youth to set directions for and carry out research addressing the social determinants of sexual health disparities. The youth co-researchers will gain valuable skills through their participation, as well as academic credit from the Prince George School Board.

"It is about young people being up front, in the driver's seat with us. This is necessary for making progress in this area."