

The CIHR Institute

CIHR's Institute of Nutrition, Metabolism and Diabetes, under the leadership of Scientific Director Dr. Diane Finewood, 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.

An important partner for the Institute is the Canadian Diabetes Association (CDA). Established more than 50 years ago, the CDA promotes the health of Canadians through diabetes research, education, service and advocacy. Together, the CDA and the Institute are building Canadian capacity to tackle the many challenging problems posed by diabetes including co-funding graduate student scholarships and multi-disciplinary teams. In addition, the Canadian Diabetes Association is working with the Institute on a health research platform for learning more about 'real world' barriers and supports to physical activity and healthy eating called Canada on the Move. They have also been working together to ensure that data generated by the National Diabetes Surveillance System is used to understand the prevalence and impact of diabetes on Canadians.

About the Canadian Institutes of Health Research

The Canadian Institutes of Health Research is the Government of Canada's agency for health research. Its objective is to excel, according to internationally accepted standards of scientific excellence, in the creation of new knowledge and its translation into improved health for Canadians, more effective health services and products and a strengthened Canadian health care system. Composed of 13 Institutes, CIHR provides leadership and support to close to 10,000 researchers and trainees in every province of Canada. For more information visit www.cihr-irsc.gc.ca

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 \$32.6 million in 2004-05 in research on diabetes.

The Facts

- More than two million Canadians have diabetes.
- Diabetes is a contributing factor in the deaths of more than 40,000 Canadians each year.
- Type 1 diabetes is usually diagnosed in childhood and involves an abnormal autoimmune response that destroys insulin-producing cells in the pancreas.
- Type 2 diabetes typically begins in adulthood, although more and more children are developing the disease. People who have a family member with diabetes, are physically inactive or 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, and kidney disease.
- The proportion of the Canadian population that reported having diabetes increased by 27% between 1974 and 2000.
- Diabetes and its complications cost the Canadian healthcare system an estimated \$13.2 billion every year in direct and indirect costs, including physician care, medication, long-term disability and early death.

Research finding solutions to diabetes

- Some 80% of people with diabetes die from cardiovascular disease. High levels of sugar in the blood of people with diabetes cause fat cells to accumulate on blood vessel walls. CIHR-funded researcher Dr. Geoffrey Werstuck of McMaster University has discovered that a molecule called valproate can reduce levels of glucose in the blood and lessen fat accumulation in the cells lining blood vessel walls. His discovery offers hope for a treatment to reduce cardiovascular disease deaths among people with diabetes.
- So-called water pills, or inexpensive diuretics, are just as effective at preventing heart attack or fatal heart disease in people with diabetes as newer, more expensive drugs, according to a joint Canada-U.S. study led in Canada by CIHR-supported researcher Dr. Frans Leenen of the Ottawa Heart Institute. The team had previously found that diuretics were better for treating most people with blood pressure problems; now they have confirmed that this is the case in people with diabetes, whose need to control blood pressure is especially urgent.
- Dr. James Wright, a CIHR-funded researcher at the IWK Health Centre in Halifax, is making genetically modified Tilapia fish that produce human insulin. If he is successful, Tilapia could become a source of islet cells for transplantation. At present, islet cell transplantation is limited, in part, by a small supply of human islet cells.

The researchers ... Dr. Pere Santamaria: Taking on diabetes

When Dr. Pere Santamaria left his native Spain, he chose Canada as the place to conduct his diabetes research. In doing so, he is building on a long tradition of Canadian achievement, dating from the discovery of insulin by Drs. Banting and Best in 1921.

As a medical doctor, Director of the Julia McFarlane Diabetes Research Centre, and CIHR-funded researcher in the Faculty of Medicine at the University of Calgary, Dr. Santamaria has been trying to understand how certain T-cells (a type of white blood cell) destroy the beta cells of the pancreas. These beta cells are essential for production of insulin.

In 2000, Dr. Santamaria discovered a group of aggressive (highly diabetogenic) T-cells in mice that attacked a beta cell protein called IGRP. This protein had not previously been seen as a target of the immune system in type 1 diabetes.

Since then, with the help of a team that includes mathematicians and molecular biologists, he has developed several animal models to demonstrate how these aggressive T-cells work. Project members have been able to predict, with great accuracy, the development of diabetes in mice by measuring the presence of these T-cells in the blood. He has also developed treatments that eliminate these aggressive T-cells and prevent the development of diabetes in mice.

Because the IGRP protein is also expressed in human beta cells, Dr. Santamaria suspects that the same T-cell attack contributes to the development of human type 1 diabetes.

The next steps for his team will be to confirm that this attack does, in fact, happen in humans, determine why these T-cells strike the IGRP protein in the first place and develop treatments that will help prevent the attack from happening.

Diabetes fascinates Dr. Santamaria because its impact goes so far beyond the physical to affect people's social and emotional functioning.

"When a family member has diabetes," he explains, "it consumes the lives of the entire family."

Dr. Santamaria takes pleasure in teaching graduate students and post-doctoral fellows how to focus and manage their research curiosity so that they can be productive in health research discovery – and contribute to the eradication of diabetes.

"I would like to shape the next generation of researchers," he says, "and show them how to think clearly about their work for the future."

- Genetic traits may be the reason some overweight Canadians develop type 2 diabetes, while others don't. CIHR supported researcher Dr. Peter Light of the University of Alberta has identified one genetic trait, a variation in a gene that controls insulin production, which, when combined with a diet high in saturated and trans fats, may double an individual's chances of developing type 2 diabetes. In the future, genetic screening may help people live a healthier life and prevent the diseases they are most at risk to develop.
- While environmental factors can trigger type 1 diabetes, genetic factors appear to play a major role. Dr. Jayne Danska of Toronto's Hospital for Sick Children, a CIHR-supported researcher, has identified a chromosomal region that is important in type 1 diabetes. Dr. Danska has found that dysfunctions in genes in three different regions act at different stages of disease development. Her work in understanding the genetics of type 1 diabetes could lead to a cure for the disease.
- Rates of dialysis among people with diabetes are 12 times greater than in people without diabetes. The finding, by a team of researchers from the Toronto-based Institute for Clinical Evaluative Sciences led by CIHR-funded researcher Dr. Charmaine Lok, underscores the importance of aggressive primary management of diabetes and its complications.

In the pipeline ... Managing diabetes care now and for the future

Dr. Jeffrey A. Johnson of the University of Alberta has spent a career grappling with the implications of type 2 diabetes for the health of individuals and for the health care system. He's found evidence that people with type 2 diabetes at risk of heart disease are not receiving medication that can reduce cardiovascular mortality. Dr. Johnson studied the costs to the health care system of such heart disease, as well as the kidney disease and sight problems that are common complications of diabetes. Now he is focusing on how to reduce the economic burden of diabetes on Canada's health care system through prevention strategies.

Lifestyle modifications, such as diet and exercise, can reduce the onset of type 2 diabetes by nearly 60% in adults at highest risk of developing the condition. Screening programs can identify these people – but they are expensive, and the payoff doesn't come for 20 or 30 years. Dr. Johnson is developing models to predict the number of people who will have type 2 diabetes 30 years from now and the likely costs of care for these people. With these strong projection models for the future, Dr. Johnson and his team will be in a position to estimate the total cost savings of investing now in effective diabetes prevention programs.