

CELL AND GENE THERAPIES IN CANADA: A HISTORY – AND FUTURE – OF EXCELLENCE

A SHORT HISTORY OF STEM CELL RESEARCH AND DISCOVERIES IN CANADA

Canada's leadership in regenerative medicine, and cell and gene therapies, is well established and has propelled Canada onto the world's stage. In 1961, two Canadians, Drs. James Till and Ernest McCulloch, advanced medical research across the globe with the discovery of blood stem cells. Over the next few decades, Canadian researchers would go on to discover neural stem cells, skin stem cells, retinal stem cells and cancer stem cells, demonstrating its considerable contribution to the advancement of fundamental biological knowledge and subsequent influence on modern medicine. **Here are just some of the major contributions that Canadian researchers and institutions have made:**

Research into how brain cells are produced led Dr. Freda Miller, The Hospital for Sick Children, to discover a repair pathway that could be activated with an inexpensive, commonly-used drug called metformin **in 2012**. Now in a Phase III clinical trial, this discovery could repair brain damage across several populations of patients, including cerebral palsy, pediatric multiple sclerosis and brain damage arising from radiation treatments.

In 2014, Dr. Tim Kieffer, University of British Columbia, published the discovery of a protocol that can turn stem cells into insulin-producing cells in a matter of weeks, making us one step closer to having an unlimited supply of insulin-producing cells to treat type 1 diabetes. Clinical studies are being planned.

In 2015, a group of researchers led by Dr. Guy Sauvageau, University of Montreal, discovered a new molecule that allows for the 10-fold multiplication of stem cells in a unit of cord blood. Along with a new type of bioreactor developed for stem culture by Dr. Peter Zandstra, University of Toronto, this discovery, now in Phase I/II clinical trials, should help cord blood find greater use in clinical application.

In 2004, a discovery by Dr. John Dick, The Hospital for Sick Children and the University of Toronto, confirmed that brain tumours originate from cancer stem cells, which maintain and fuel tumour growth. Today, this proof of cancer stem cells has informed research around the world.

In 2000, Dr. John Bell, Ottawa Hospital Research Institute, discovered a novel class of targeted cancer therapeutics, oncolytic viruses, which could be used to specifically infect, replicate within, and destroy cancer cells while leaving normal cells unharmed. This was based on the seminal observation that higher-level cancer cells' biological properties or behaviours, rather than an individual's gene mutations or molecules, could be targeted therapeutically.

Researchers led by Dr. Michael Rudnicki, Ottawa Hospital Research Institute, discovered **in 2013** a trigger that turns muscle stem cells into brown fat, generating hope for obesity treatments.



PAVING THE WAY FOR A FUTURE OF EXCELLENCE

The Government of Canada, through the Networks of Centres of Excellence program, and provincial governments have helped to establish organizations that span the breadth and depth of the regenerative medicine and cell and gene therapy pipeline. These organizations support research and collaboration, and advance the commercialization and manufacturing process, which are important in the development of treatments. Canada's academic institutions play a key role by producing world-class research.

CANADA SUPPORTS CELL AND GENE THERAPIES, FROM DISCOVERY AND PROMOTING KNOWLEDGE SHARING...

... to Funding Research



BioCanRx funds translational immunotherapy research providing research funding, access to core facilities, and expertise in concert with biotech, patient groups and health charities to translate immune-based technologies from the lab into early-phase clinical trials.

biocanrx.com



The Ontario Institute for Regenerative Medicine (OIRM) funds basic and translational science in the province of Ontario, with a focus on delivering new commercial products and therapies to revolutionize the treatment of degenerative diseases. OIRM is funded by the Ontario Ministry of Research, Innovation and Science.

oirm.ca



The Stem Cell Network's mandate is to act as a catalyst for enabling the translation of stem cell research into clinical applications, commercial products and public policy. This is achieved by supporting translational stem cell and regenerative medicine research projects and clinical trials across Canada.

stemcellnetwork.ca

... to Commercialization



CCRM accelerates the translation of scientific discovery into marketable products and new companies with specialized teams, diligence, funding and infrastructure, tied to global academic, industry and commercialization networks.

ccrm.ca



The Centre for Commercialization of Cancer Immunotherapy (C3i) provides an integrated structure to accelerate the discovery, development, commercialization and access to innovative cancer immunotherapies.

centrec3i.com

... to Good Manufacturing Practices (GMP) Facilities



CellCAN provides access to a network of GMP facilities across Canada, and mobilizes knowledge and stakeholders to advance regenerative medicine and cell therapy in Canada.

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... WITH THE GOAL OF MAKING TREATMENTS AVAILABLE TO PATIENTS

