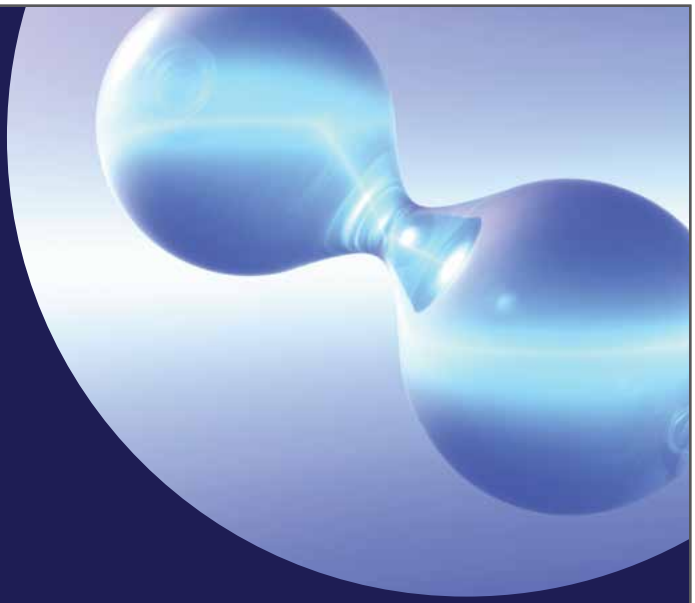
The Path to Cures – Investing in Canadian Cell Therapy Research



Pre-Budget Submission – 2025
Breakthrough T1D™ Canada

RECOMMENDATION

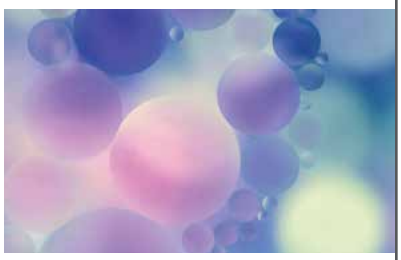
Breakthrough T1D™ Canada (formerly JDRF) recommends that the Government of Canada invest $15 million over 4 years on cures research for type 1 diabetes, with a focus on cell therapy research to get us closer to functional cures for the disease. Breakthrough T1D commits to securing matching funds for this investment for a total research impact of $30 million over four years.

What is cell therapy?

Regenerative medicine, more specifically cell therapy, has the potential to be the cure-all to many diseases that have had limited therapeutic options to date. Cell therapies can be designed to reprogram existing cells or replace damaged and destroyed cells to restore cell function and health. The evolution of cell therapy in the past two decades ignited a paradigm shift within medicine. It is expected that as many as 60 new, transformative cell and gene therapies could come to market in the next 10 years.[1] Further accelerated by the development of CRISPR-Cas9 technology, which enables targeted editing of specific genes – and therefore functions – within cells, a new world of options has opened up for many disease cures.

For type 1 diabetes (T1D), cell therapy refers to the replacement (transplantation) of glucose-sensing, insulin-producing beta cells into the body to provide insulin independence. By restoring the body's ability to produce insulin in response to glucose levels, T1D would be 'cured' and long-term complications (such as heart, kidney, and eye disease) would be virtually halted or avoided entirely. The promise of cell therapy as a cure for T1D intensified 10 years ago, when it was shown for the first time by Canadian researchers that human stem cells could be used to create insulin-producing cells in the lab with the potential to replace those lost in people with the condition. Cell therapies have the potential to benefit the estimated 300,000 Canadians living with T1D, and a further 8 million around the world. Moreover, investing in cell therapy research for T1D can help to pave a path for cures to other autoimmune, neurogenerative and heart diseases.

T1D results when the body's own immune system mistakenly destroys insulin-producing beta cells in the pancreas, causing blood sugar to rise uncontrollably. Since the Canadian discovery of insulin in 1921, which meant that T1D was no longer a fatal disease, no new therapies have been approved for T1D. Despite advances in self-management made possible with glucose monitors and insulin pumps, this disease still requires 24/7 attention and carries a high risk of burdensome and costly complications. The prevalence of T1D is climbing by 4.4% every year[2] – faster than the general population growth of 1.2% per year.[3]



Breakthrough T1D™
Formerly JDRF

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Why Breakthrough T1D Canada is best suited to build on the momentum of cell therapy research in T1D

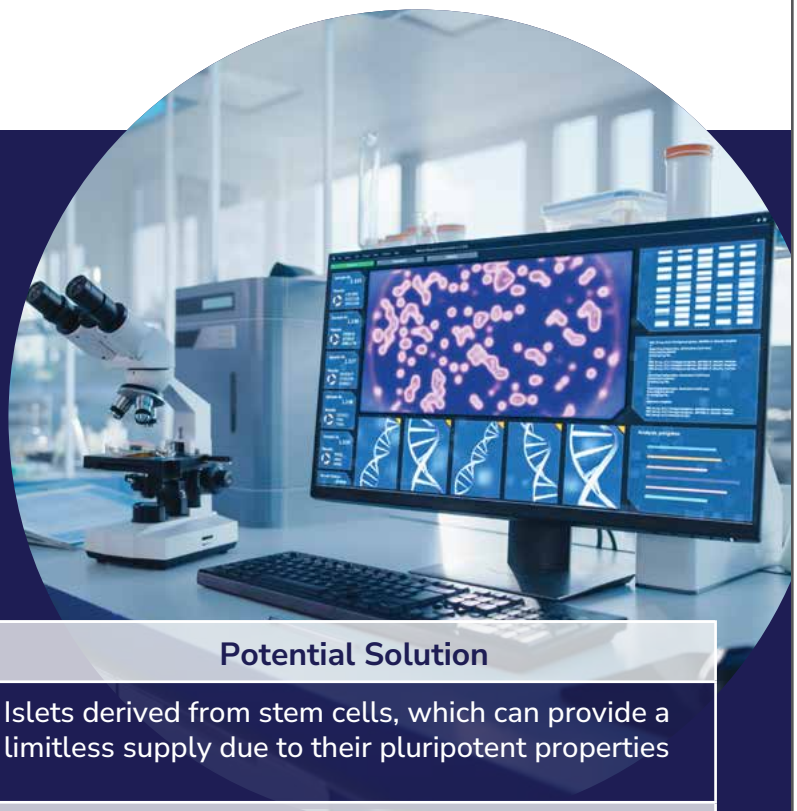
Breakthrough T1D is the leading charitable funder of T1D research in the world. Since 1974, Breakthrough T1D(then known as JDRF) has been part of nearly every major scientific breakthrough for T1D. We have enabled numerous breakthroughs in the cell therapy field, convened multidisciplinary consortia to drive research collaboration and progress, supported first-in-human clinical trials, played a part in commercialization of crucial cell therapy technologies, partnered with industry, and engaged with regulators to map a path to approval of cell therapies.

Our goal is to meet the major unmet need in the T1D community for cell therapies that replace insulin-producing cells to provide freedom from insulin therapy and eliminate the risk of life-altering diabetes complications. Canada has a remarkable legacy and high standards in diabetes discoveries, islet transplantation, stem cell science, and clinical trials, giving us a head start to lead the world in advancing these therapies. Breakthrough T1D, with our track record of success in the cell therapies field, our global strategy to accelerate new cell therapy products to commercialization, and our history of impactful Canadian research partnerships, is ideally suited to allocate and coordinate new funding for cell therapies for T1D in Canada.

The Breakthrough T1D (formerly JDRF) - CIHR Partnership to Defeat Diabetes established in 2017 has made significant progress in T1D research, funding over 20 active large projects, including substantial investments in cell therapy. These projects focused almost entirely on discovery and pre-clinical research, leveraging the expertise of the CIHR Institute for Nutrition, Metabolism and Diabetes. It is imperative that we don't stop now and lose the incredible momentum we have created. The field needs an influx of funds to continue moving these advances past the translational stage with an eye towards clinical trials and commercialization - and Breakthrough T1D Canada is best positioned to lead this work.

Past partnerships with CIHR ($60M in combined funding from 2017 to present), Brain Canada ($750k), and Stem Cell Network ($4M starting in 2025) illustrate our capacity to collaborate with other organizations to leverage funding and extend our reach and impact for the benefit of the T1D community.

Over the past 5 years, the Government of Canada has committed an estimated $30M (via CIHR and Stem Cell Network) to diabetes-related cell therapy. In that same period, Breakthrough T1D has committed $30M demonstrating that current government funding levels are not sufficient to accelerate cell therapy research in Canada. Significant amounts of this research remain in the academic domain. What is needed is a boost of funding specifically focused on creating new mechanisms by which to translate and commercialize the most promising work in this field. The level of research excellence that exists in Canada coupled with the right funding can make a global impact in the science of cell therapy. And Breakthrough T1D can be the nucleus that cohesively brings all the elements together. Our exclusive focus on T1D enables us to drive progress in this area and our global, collaborative network can be leveraged to connect research efforts and outputs and reduce redundancies paving the way for impact.



The current landscape of cell therapy in type 1 diabetes

Although there are currently three industry-led clinical trials for cell therapy ongoing in Canada, there are still many hurdles that research needs to overcome to see a safer, scaled-up, cost-effective, and acceptable product accessible for people of all ages with T1D.

Those hurdles include:

Challenges	Potential Solution
Limited supply of donor islets	Islets derived from stem cells, which can provide a limitless supply due to their pluripotent properties
Large number of people with T1D seeking cure therapies	Scale up cost-effective methods to manufacture stem cell-derived islets
Invasiveness of islet transplantation	Further explore safer and less invasive sites for transplantation, such as the skin
Low long-term survival and function of transplanted cells	Next-generation encapsulation devices, gene editing to enhance cell survival and/or function, enhancement of vascularization, and more
Risks of lifelong immunosuppression needed with a cell or tissue transplant	Cell protection or immune evasion to eliminate the need for conventional immunosuppression

We need to pursue several tactics to make cell therapy the cure for T1D. As such, with this funding, we plan to work with all parties (academia, industry, government) to build on incredible progress and not lose the momentum. Academic research in Canada, including at the Breakthrough T1D Centre of Excellence at the University of British Columbia established in 2021, has been at the forefront of cell therapy advances for T1D. Sustained research funding is essential to leverage this momentum and help to translate current research – much of it in the academic domain – to clinical trials and commercialization, and to accelerate cures to market.

Alignment with Federal Priorities

Breakthrough T1D's recommendation aligns with key research opportunities outlined in the National Framework for Diabetes, "*[e]nhance investments for innovative diabetes research for all types of diabetes in Canada to support strong investigator-initiated and strategic research*," and can provide both the accountability and success metrics required for reporting purposes in 2027.[4]

This recommendation also supports Canada's Biomanufacturing and Life Sciences Strategy's priorities, ensuring investments flow towards the country's research infrastructure and developing the talent behind it.

Economic impact

Breakthrough T1D has a proven record of success in funding research that drives progress through the pipeline towards commercialized therapies with high potential to improve the lives for people with T1D.

Research investments by Breakthrough T1D have spun off into companies, creating jobs and stimulating investment. Our interactions with industry include work through the Breakthrough T1D Fund, one of the largest disease-focused venture philanthropy funds in the world, which catalyzes industry efforts to accelerate cure-oriented therapies and has stimulated substantial leverage from other sources to the T1D field. More than 10 successful company exits have resulted from this Fund.

Another great example of this is Breakthrough T1D-funded research studies by Dr. Timothy Kieffer (UBC) and Dr. Douglas Melton (Harvard University) who simultaneously discovered the capability for stem cells to become insulin-producing beta cells. In the 5-years that followed this incredible advancement, these cells were translated into a commercialized product that has moved into clinical trials. Dr. Timothy Kieffer's cells were licensed by ViaCyte who, with Breakthrough T1D funding, initiated the first-ever clinical trial of a stem cell-derived islet product – right here in Canada. Similarly, after years of Breakthrough T1D funding in academia, Dr. Douglas Melton created Semma Therapeutics, a company that was later acquired by Vertex Pharmaceuticals. These cells are now being tested in people with T1D in international clinical trials. These trials were made possible by academic-based research, and we strongly believe that it will take the involvement of several partners (including academia, industry, Breakthrough T1D, and government)

to ensure that multiple cure products get to market in order to ensure patient choice, access, and affordability.

Other Canadian companies in this space that have mainly come out of academia include Allarta Lifescience, Sernova, and Aspect Biosystems. As evident, the potential ROI to our economy is immense compared to the investment amount we are recommending.

Not only does an investment in research mean an investment in intellectual property and future commercialization, it also provides an immediate source of funding for training the next generation of researchers and clinicians in Canada. In 2023, Breakthrough T1D grants funded over 383 trainees, research technicians, and other research support personnel across 46 research grants.

Furthermore, the long-term effects of bringing new solutions and functional cures to market for T1D will ultimately reduce health care costs by reducing hospitalizations due to T1D-related complications (including diabetic ketoacidosis, hypoglycemia, kidney and cardiovascular disease, and mental health disorders), as well as improve quality of life. Over 80% of Canadians living with T1D are adults, with an estimated 84,100 people over the age of 60 living with T1D. In working-age adults, a cure for T1D would reduce absenteeism and presenteeism related to T1D and will have immediate and long-lasting economic and health system impacts.

The economic rate of return on scientific investment is woefully underestimated. In a recent report from The Royal Society, the contribution of science to the economy was classified into four valuable impacts: knowledge and ideas; innovation and productivity; skilled people and jobs; and wider economic impacts such as improved public health.[5] The opportunity cost of not investing in critical cure research is too vast to ignore.

CONCLUSION

The potential of cell therapies to significantly improve the quality of life for individuals with T1D while also reducing the strain on the healthcare system cannot be overstated.

With Canada's strong legacy in diabetes research and cutting-edge advancements in cell therapy, we must continue to establish our competitive position on the global stage, which includes translating research success into health innovation and impact by increasing coordinated research funding, collaboration, and the talent pipeline. Breakthrough T1D Canada is a proven and trusted partner who has the expertise, demonstrated ability and commitment to do exactly this.

Notes:

1. Andrews, S. M., et al. (2022). Preparing newborn screening for the future. BMC Pediatrics, 22(1). https://doi.org/10.1186/s12887-021-03035-x

2. Type 1 diabetes index. Type 1 Diabetes Index. (2022, September 20). https://www.t1dindex.org/ (Accessed July 31, 2024).

3. Statistics Canada. (2024). Canada's population estimates: Strong population growth in 2023. The Daily. https://www150.statcan.gc.ca/n1/en/daily-quotidien/240327/dq240327c-eng.pdf (Accessed July 31, 2024).

4. Public Health Agency of Canada. (2022). Framework for Diabetes in Canada. Government of Canada.

5. Royal Society. (2024). Science 2040: The economic value of science. Retrieved from https://royalsociety.org/-/media/policy/publications/2024/science-2040-economic-value-of-science.pdf