

Written Submission for the Pre-Budget Consultations  
in Advance of the 2019 Budget

Genome Canada

August 3, 2018

## List of Recommendations

- 1. We recommend that the Government of Canada adopt the recommendation of the Advisory Council on Economic Growth: “identifying a few sectors where Canada has a strong endowment, untapped potential, and significant global growth prospects” ...and that...” Canada take a focused approach that removes barriers and galvanizes the sector around a bold growth agenda.”**
- 2. We recommend that the government give priority to the funding of pre-commercial/translational research in genomics and other disruptive technologies because of their contribution to the competitiveness of the Canadian economy.**
- 3. We recommend that the government continue to support research into the social implications of disruptive technologies such as genomics, gene editing and synthetic biology, and the dissemination of trustworthy information on these technologies and related topics such as genetic discrimination, etc.**
- 4. We recommend that the government extend funding for Genome Canada and endorse its vision for the development of a Canadian knowledge-based bioeconomy.**

## Introduction

Genome Canada was created in 2000 as an independent organization dedicated to harnessing the transformative power of genomics and to driving strategic investment in genomics and related biotechnologies for Canada's benefit. We are a specialist, value-added agency that provides strategic funding, direction, management and oversight of research projects designed to ensure the best possible social and economic outcomes from the rapid development and deployment of genomics-based technologies.

Partnerships are at the heart of our business model. In collaboration with partners—provincial governments, academic institutions, non-profit organizations, national and international research funding organizations and, increasingly, businesses from multiple sectors—we ensure that genomic investments have the greatest impact and maximize the value of the federal investment through co-funding. Since its founding, Genome Canada has leveraged \$1.5 billion in federal investment into \$3.6 billion in research and development across the country. We are also deeply-rooted in Canada's regions, working in a collaborative network with six regional Genome Centres—Genome British Columbia, Genome Alberta, Genome Prairie, Ontario Genomics, G enome Qu ebec and Genome Atlantic.

## Bringing innovation to life

A genome is a living organism's complete set of DNA, including all of its genes. Genomics is an interdisciplinary field of science focusing on the structure, function, evolution, mapping, and editing of genomes. Genomics is also the toolkit for creating innovation in living things. Genomics brings innovation to life.

Genome Canada's mandate is at the nexus between fundamental research and its application. Creating basic understanding of the genome was far more complex than initially expected. While there is still much more to learn about how life works, today, more and more applications of what we have learned about genomics are changing the way we live as Canadians.

Translating discoveries into applications underlines the enormous capacity that innovation in life sciences represents across many key sectors of our economy. Reading and understanding the "code of life" is enabling the transformation of these sectors. Huge benefits are being realized —for agriculture, forestry, fisheries and aquaculture, natural resources, the environment and health care. These tools and applications are now beginning to explode, contributing significantly to Canada's productivity and competitiveness:

- Farmers now obtain "genetic scores" when they purchase breeding stock of dairy cattle;
- Genomics is identifying trees that are more disease- and drought-resistant for reforestation;
- Traditional knowledge is being combined with cutting-edge genomic knowledge to track the movement of fish populations in the north;
- Energy companies are using microbiomics to help identify offshore oil deposits;
- Specialized bacterial populations are being identified to clean up tailings ponds; and
- Doctors are sequencing patients with rare diseases to shorten and focus the diagnostic process.

## Innovation and competitiveness

The federal government has an opportunity to be a world leader in leveraging our capacity in genomics and biotech to increase the competitiveness of the Canadian economy. Dominic Barton, chair of the federal Advisory Council on Economic Growth, has spoken about the important links between innovation, genomics, productivity and export trade, in the context of the agriculture and food sector:

“Canada has already done a lot of innovation in agriculture and food. It’s a natural area for us. There’s precision agriculture, where you use big data, where you know how much water and how much fertilizer you should put into the ground, to use resources more effectively and efficiently. And genomics researchers in Canada have done good work in developing a variety of soybeans, which normally need more temperate conditions, to grow on the Prairies. With pulse products, there have been good innovations in Saskatchewan in particular. With the demand from Asia for protein, this particularly means soy and pulse products. I think we’ve got a really good base.”<sup>1</sup>

In its report “Unleashing the Growth Potential of Key Sectors,” published February 6, 2017, the Advisory Council suggested that “certain sectors of the economy have significant untapped potential that will require focus and attention to unlock.” The Committee identified eight potential candidates for a “focused, sectoral approach to economic development,” four of which are areas where genomics is already making an impact in increasing Canada’s competitiveness: agriculture and food, energy and renewables, mining and metals, and health care and life sciences.<sup>2</sup>

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## Pre-commercial/translational research

Pre-commercial/translational research seeks to apply cutting-edge knowledge and techniques to real-world application. It focuses on developing deliverables to well-defined, user-driven problems, and is crucial to creating the products, services, devices and techniques in applications that create value for users.

There is currently a gap between the fundamental research being done by university and government scientists and the commercialization of new technologies by biotech startups and multinational companies. This research gap is made more challenging because genomics is inherently multi-disciplinary. Biologists and health researchers must be involved, but also engineers and technologists, as well as social scientists such as economists, and, of course, the users who understand the need for a particular application.

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<sup>1</sup> Mary Gooderham, The Globe and Mail, December 7, 2016, *Canada’s next big economic pitch: to feed a hungry world.*”

<sup>2</sup> Page 2

The need to address this gap has been noted by Dr. Mona Nemer, Canada’s Chief Science Advisor: “We need to mend the gap between discovery and innovation. There are some areas that are ripe for harnessing previous investments, like quantum physics, AI, genomics and others.”

- 2. We recommend that the federal government give priority to the funding of pre-commercial/translational research in genomics and other disruptive technologies because of their contribution to the competitiveness of the Canadian economy.**

### Mitigating disruption: Research into the implications of disruptive technologies in society

Genomics is a deeply-disruptive technology with immense promise of benefits, but also potential risks if not used properly. It is crucial that we understand the social implications of disruptive technologies like genomics to maximize their potential for social and economic development without risk to Canadians or their environment.

For example, by enabling gene editing, CRISPR-based technology has created the ability to precisely manipulate human and other genomes. This technology can be used in basic science, or for improvements to crops, livestock and human health. The potential benefits to gene editing are enormous, but there remains numerous uncertainties and potential risks; ongoing research into the implications in society is essential.

Furthermore, potential economic and other benefits of new technologies are threatened by popular misunderstanding and misperception of research evidence. It is essential that trustworthy information about rapidly-developing science and technology is created and shared with policymakers and the public so that effective decisions can be made and benefits can be appropriately balanced with risks.

- 3. We recommend that the federal government continue to support research into the social implications of disruptive technologies such as genomics, gene editing and synthetic biology, and the dissemination of trustworthy information on these technologies and related topics such as genetic discrimination, etc.**

### Bringing innovation to life

Around the world, countries are seeking the economic and social benefits from leveraging research in the biological sciences and driving innovation in the bioeconomy. The bioeconomy – all economic activity rooted in biology, including in health, agriculture and agri-food, fisheries and aquaculture, forestry, cleantech, energy, mining and more – is estimated by the Organization for Economic Co-operation and Development (OECD) to be worth \$1 trillion worldwide by 2030.<sup>3</sup>

Because of its enormous natural endowment, Canada has built world-leading industries in the ag-food sector, fisheries and forestry. Add public and private investments in health care, and Canada is clearly a global bioeconomy leader.

Driving growth in this sector will be those countries who are innovation leaders, who are best equipped to read, interpret and – increasingly – write the biological code found in all living things. Genomics unlocks the operating software for the living world. To maintain and grow our natural advantage and to

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<sup>3</sup> The Bioeconomy to 2030 – Designing a Policy Agenda, OECD, 2009

continue to expand our exports, Canada must also be a leader in the fundamental technology that drives all biological systems. We cannot be first rate on production and third rate on technology.

Genome Canada brings innovation to life. Since our founding in 2000, Genome Canada has supported Canadian researchers working to read and interpret the biological code and to apply new knowledge to Canadians' economic, social and environmental benefit. Genome Canada has leveraged a cumulative \$1.5 billion federal investment with \$2.1 billion in additional funding from provinces, industry and other partners, supporting hundreds of large-scale, applied projects with multidisciplinary teams working at the cutting-edge of biology, biotechnology and innovation.

Genome Canada's mandate has evolved from the early days of genomics, when sequencing the complete gene set of a single organism was a monumental achievement, to today when scientists read hundreds or thousands of genomes during a project, and employ gene editing, synthetic biology and other disruptive technologies to tackle persistent biological challenges. Genome Canada's new strategic plan sets out a vision where Canada is a world leader in biotechnology and the bioeconomy, understanding and employing organisms' genomes to improve health, mitigate and adapt to climate change, increase agricultural output and more. Genome Canada's funding is scheduled for review and renewal in March 2019.

- 4. We recommend that the federal government extend funding for Genome Canada and endorse its vision for the development of a Canadian knowledge-based bioeconomy.**