



GenomeCanada

GLOBAL CHALLENGES ♦ GENOMIC SOLUTIONS

PUSHING THE
frontiers of



2018-19
Annual Report



Table of Contents

Annual Report



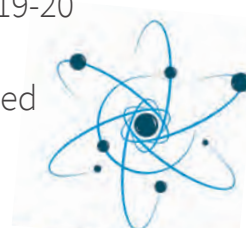
- 1** Messages from the Chair
- 2** Message from the President and Chief Executive Officer
- 4** Succes Stories
 - 3** Special Initiatives
 - 4** Large-scale science
 - 7** Leading-edge technologies
 - 10** Translation



- 11** Year in Review
 - 11** Introduction
 - 13** Highlights
 - 15** Pursuing Our Objectives
 - 27** Objectives for 2019-20



- 28** Active Projects Funded
- 41** Appendices
 - 41** Genomics Enterprise
 - 42** Governance
 - 45** Financial Managements
 - 47** Auditor's Report
- 46** Acknowledgement





GenomeCanada

Genome Canada is a not-for-profit organization that acts as a catalyst for developing and applying genomics and genomics-based technologies and, in so doing, creates economic and social benefits for Canadians.

Published by Genome Canada

Excerpts from this document may be reproduced for individual use without permission, provided the source is fully acknowledged. Reproduction in whole or in part for purposes of resale or redistribution, however, requires written permission from Genome Canada.

© Genome Canada 2019

Cette publication est aussi disponible en français.

Messages from the Chair and the President and Chief Executive Officer



It has been my pleasure to serve as the Chair of Genome Canada for three years. As my term ends, I continue to be amazed by the immense promise of genomics and the exciting and impactful work of Canada's researchers. Canadians are not always good at trumpeting our success, but make no mistake—we are making a difference in health, the environment and the economy through the skill, passion and commitment of Canadian researchers and those who support them and carry their discoveries into the real world.

This has been an important year for Genome Canada. We spent a year in reflection as we reimagined a Strategic Vision for the next phase of the organization's development. A year of dialogue with our research community, listening to hopes and dreams about genomic science and how it can change the world.

What did we hear?

We heard that this is an exciting time for genomics—as we push new technologies and data analytics into new areas of understanding, we create ever-greater opportunities to see impact across Canadian sectors. We heard that Canada has amazing strength in genomics, with world-leading research in emerging areas like energy, mining, and the environment. We

“We heard that this is an exciting time for genomics—as we push new technologies and data analytics into new areas of understanding, we create ever-greater opportunities to see impact across Canadian sectors.”

— *Moura Quayle, chair*


heard that our interdisciplinarity is essential—our unique approach to integrating technology and scientific research with research into its ethical, environmental, economic, legal and social impacts. And we heard that the Genome Canada model—a collabora-

tive model of co-development, co-delivery and co-funding with our regional Genome Centres—provides a regional perspective essential for combining world-class research with actual economic impact.

We also heard that much remains to be done.

We heard about enormous opportunities in new areas of science like gene editing, synthetic biology, and the microbiome. We were reminded that pushing the frontiers of knowledge and technology opens new challenges for policymakers, clinicians and the public. We heard about the need to link with our international partners, coordinating efforts to tackle some of the largest challenges of our time: climate change, antimicrobial resistance, biodiversity. And we have been encouraged to double down on our efforts to increase the equity, diversity, and inclusion in our community of researchers.

I am proud of the work Genome Canada has done during my three years as Chair, and I thank the Board, the Science and Industry Advisory Committee, the staff, and the community for their enthusiasm and hard work. And I am encouraged to know that there remain enormous challenges to tackle because I am convinced that Genome Canada will continue to lead the way in tackling them. As this year's annual report demonstrates, these are exciting times for genomics, Genome Canada and for all Canadians who benefit from the research being supported here and I wish all of you continued success.



Moura Quayle,
Chair



“What motivates us—and what is demonstrated here—is the belief that the best is yet to come.”

— Marc LePage, president and CEO

What a year. Even after nearly 20 years, Genome Canada continues to work at the cutting edge of the biosciences, taking the most advanced science and technology and translating it into application. Our continued success is an endorsement of the Genome Canada model: a networked enterprise of Genome Centres building large-scale interdisciplinary teams to tackle the biggest challenges in life sciences, working across sectors as diverse as health, agriculture and agri-food, forestry, fisheries and aquaculture, environment, energy and mining. Add to that a little ‘secret sauce’ of equal parts passion and commitment and you get a recipe for success, as reflected in the renewal of Genome Canada funding with \$100.5 million in Budget 2019.

This year was an important and successful one for Genome Canada. We launched several new academic-industry partnership projects through our wildly popular Genomic Applications Partnership Program (GAPP) while also concluding prestigious community-building competitions in Bioinformatics and Computational Biology (BCB) and Disruptive Innovation in Genomics (DIG). In all cases, I am continually inspired by the research happening in Canada and its potential for impact.

We also forged a groundbreaking partnership with Agriculture and Agri-Food Canada (AAFC) to launch a co-funded Large-Scale Applied Research Project competition in agriculture, agri-food, fisheries and aquaculture. These projects will bring academic scientists and government scientists, together with users from industry and the public sector to improve Canada's performance in this crucial economic sec-

tor. I want to congratulate the leadership group at AAFC who shared our vision to support a “team Canada” approach to science – breaking down organisational silos so that the best Canadian scientists can come together to address important problems whether they are in government labs, in academia or in industry.

We continue to work productively with our Genome Centres across Canada, reinforcing a distributed model that combines national breadth with regional depth. Our new Regional Priorities Partnership Program is designed to prioritize provincial or regional opportunities that support the national mission. We also aligned our communications and outreach activities more closely, including through a National Dialogue Series on Genomics that saw public outreach events occur across Canada.

This year also saw the launch of a major national initiative in the precision health of rare disease. Bringing together clinicians and researchers from across Canada, this Genome Canada-led initiative aims to make genomics-based precision health available to every rare disease patient in Canada within three years. Working with provincial governments, pediatric hospitals, clinicians, researchers and patients, this initiative is tackling barriers to implementation while opening opportunities for improved diagnosis and care.

This was also an important year for internal matters at Genome Canada. We engaged our community in the development of a new Strategic Vision, conducting consultations and meetings throughout the year, identifying new opportunities for the next phase of Genome Canada's growth. We also conducted a significant review of our integrated GE³LS¹ program, recommitting to this innovative interdisciplinary approach to genomic research. And finally, we developed and launched an Equity, Diversity and Inclusion (EDI) action plan – committing to increasing representation across underrepresented groups at Genome Canada.

Clearly, there is a lot happening at Genome Canada. As we head toward our 20th anniversary next year there is a natural tendency to look back at our successes and appreciate the good work that has been done. But what motivates us—and what is demonstrated here—is the belief that the best is yet to come.



Marc LePage
President and chief executive officer

¹ GE³LS = Genomics and its Ethical, Environmental, Economic, Legal and Social aspects



Prioritizing Mental Health Research

Bipolar disorder is a chronic psychiatric illness that affects an estimated 500,000 Canadians and is one of the top causes of disability and mortality worldwide. Genetic factors influence who is at risk and how individuals respond to treatment. Mental health researchers **Drs. Martin Alda and Rudolf Uher** from Dalhousie University are examining the genetic factors that play a role in the disorder in order to develop new clinical tools and improve diagnosis. By taking a genomics-based approach, this research will help streamline diagnosis and identify long-term treatment for patients at the individual level. *This project is supported under the Regional Priorities Partnership Program (RP3), which aims to advance the unique economic opportunities and sector priorities among Canada's regions.*



Precision Health: Bringing a National Strategy to Life

Precision health has the potential to transform the healthcare experience in Canada. Genome Canada is committed to maximizing the benefits of precision health and is laying the foundation for the implementation of precision health in clinics across Canada through its national strategy.

Improving Diagnoses for Rare Diseases

There are more than 7,000 rare genetic diseases in Canada, while a third of them remain unsolved. Canadian researchers have developed new expertise in understanding the underlying biology of rare childhood disorders through exome sequencing, a method of testing all genes at once. The research team, led by **Dr. Kym Boycott** of the Children's Hospital of Eastern Ontario, has already solved hundreds of disorders. This type of genomic sequencing will speed up diagnostic processes and improve the overall care and wellbeing of young patients.

Making Pre-natal Screening Safe

Every year in Canada, about 10,000 pregnant women undergo amniocentesis to screen for genetic abnormalities. Approximately 70 healthy fetuses are lost due to complications. Recently, researchers discovered that fetal DNA present in the mother's blood can test for genetic abnormalities through a simple blood test. **Dr. François Rousseau** of the *Université Laval* and **Dr. Sylvie Langlois** of the University of British Columbia spearheaded the Personalized Genomics for Prenatal Aneuploidy Screening Using Maternal Blood (PEGASUS) project to develop the safest, most accurate genetic testing for fetuses.

Simplified Screening for Breast Cancer



Breast cancer is the most common cancer and second leading cause of cancer death in Canadian women. Yet many women at high risk for the disease are not properly screened. **Dr. Jacques Simard** of the *Université Laval* and his research team have developed a simple saliva test to gauge a woman's risk of developing breast cancer, now the most accurate risk-prediction model to date. By combining the genetic profile obtained through the saliva sample with a family history, hormonal factors and lifestyle habits, the researchers can estimate each woman's overall risk for breast cancer.



Stopping Invasive Species in Their Tracks

Canadian forests play a key environmental role, cleaning the air and water, storing carbon and providing habitat to wildlife. Invasive alien species that enter the country through imported goods are often to blame and the damage costs an estimated \$800 million a year. **Dr. Richard Hamelin** of the University of British Columbia, along with the Canadian Food Inspection Agency, is harnessing the power of genome sequencing and bioinformatics analysis to develop bio-surveillance tools to rapidly detect harmful forest enemies to avoid future damage.

Decoding the Wheat Genome



In Canada, wheat accounts for more than \$4.5 billion in annual sales, adding more than \$11 billion each year to the economy. To meet future demands of the world population, wheat productivity needs to increase by 1.6 per cent each year until 2050. Led by **Dr. Curtis Pozniak** of the University of Saskatchewan, Canadian scientists played a pivotal role in cracking the complex wheat code and published a detailed description of the genome of bread wheat. This breakthrough has implications for future research in this vital crop and will help produce hardier varieties that are more productive and resistant to disease and climatic changes.

Ensuring the Future of Wildlife

Deer, elk, moose and caribou, also known as cervids, are iconic to the Canadian landscape. Since the late 1960s, a fatal disease known as chronic wasting disease (CWD) has threatened cervid populations in the prairies. **Dr. Debbie McKenzie** and **Dr. David Wishart** of the University of Alberta are leading research that will use genomics and metabolomics to develop tools to test cervids and their environment, identify CWD strains, model risk and reduce the spread of the disease.



Optimizing the Dairy Business in Canada



Dairy is big business in Canada, with 1.4 million cows responsible for \$6.17 billion in revenue each year. Dairy in Canada is also unique in that production is subject to a quota system. This makes optimizing productivity a key ingredient to a farm's profitability. **Dr. Abdoulaye Baniré Diallo** of the *Université du Québec à Montréal* and **Dr. Marc-André Sirard** of *Université Laval* are developing tools that will integrate production and genomics data, driving the development of new management practices and allowing a precise productivity estimate for individual cows.



Predicting the Consequences of Antimicrobial Resistance

Dr. Robert Beiko of Dalhousie University, **Dr. Fiona Brinkman** of Simon Fraser University and **Dr. Andrew G. McArthur** of McMaster University are developing new software and database platforms to provide a near-instantaneous picture of AMR organisms.



Canadian Honeybees

Honeybees play a critical role in Canadian agriculture. They are responsible for pollinating many crops, nuts and oil seeds and contribute more than \$4.6 billion to the Canadian economy annually. Since 2006, Canadian beekeepers have lost more than a quarter of their colonies. **Dr. Leonard Foster** of the University of British Columbia and **Dr. Amro Zayed** from York University have teamed up to develop genomics and proteomics tools to breed healthy, disease-resistant, productive bee colonies that are better able to survive Canadian winters.



The Multipurpose Advantage of Biodiversity Tools

Surveying biodiversity is critical to many sectors of the Canadian economy. It is particularly essential to Canada's growth in the forestry, agriculture, and fishery sectors and to decision-making in public health.

Dr. Sarah Adamowicz and **Dr. Paul Hebert** at the University of Guelph are creating new bioinformatics tools that will facilitate rapid processing of DNA data from the environment. These new tools will support large-scale biodiversity research, effective environmental assessments for industry and more accurate biodiversity data for decision-makers.

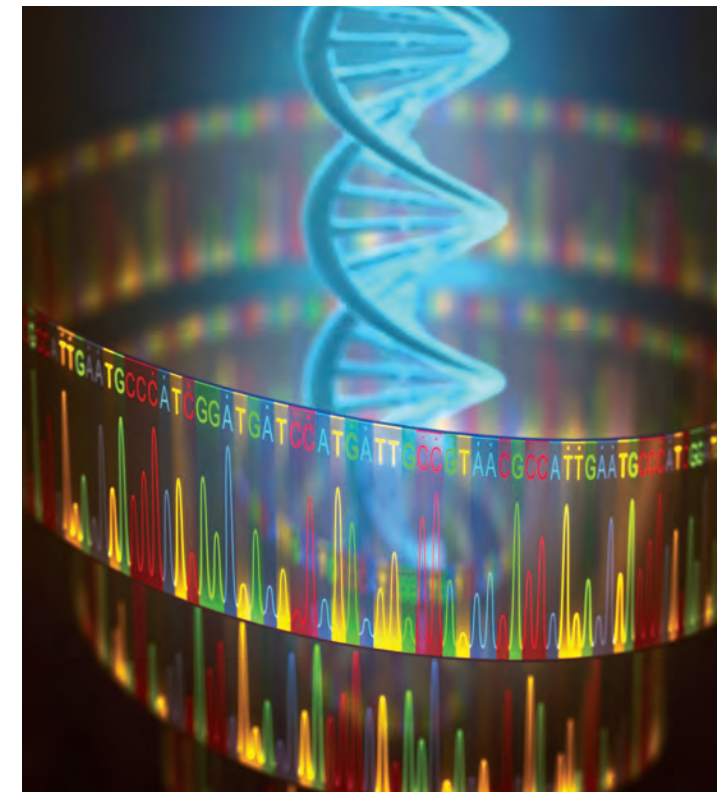


Feeding a Growing Population

By 2050, the world population is expected to reach nine billion people. Agricultural production will need to increase by 60-70% to keep pace. To help understand plant and animal productivity, **Dr. Gregory Butler** of Concordia University is developing *TooT Suite*, a bioinformatic tool that examines the interactions between plants and animals with their microbial communities, which significantly affect their overall productivity. *TooT Suite* opens an era where genomics and big data collide for the agricultural research needed to address future food security.



The Growing Importance of Data-Sharing Technologies

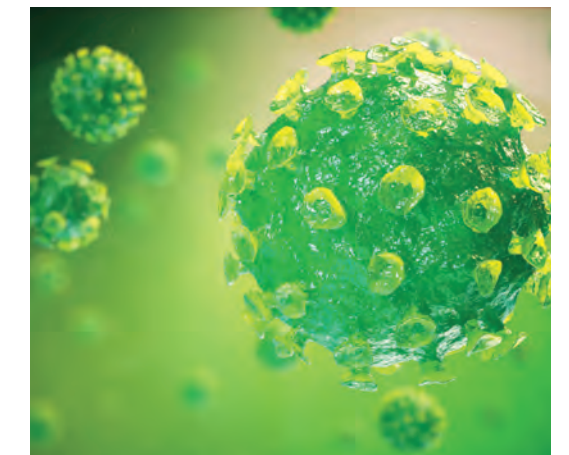


Improving Healthcare through Data-Sharing Technologies

Canadian scientists have made exciting discoveries about the complex relationship between genetic mutations and disease. However, much of this information is spread across dozens of databases in differing formats. Researchers and clinicians need an accessible resource designed for sharing and combining data to improve patient outcomes. **Dr. Jordan Lerner-Ellis** and **Dr. Matthew Lebo** are addressing this issue by creating a shared, open-source genetic database that combines the work of clinical and research laboratories.

Preventing the Spread of Infectious Disease

Infectious diseases can devastate animal and human populations, damage economies and paralyze trade. Genomics tools have transformed the detection of infectious pathogens; but without a secure data-sharing platform, their use in real-time is limited. **Dr. William Hsiao** of the University of British Columbia and the Public Health Agency of Canada have teamed up to create new data-sharing platforms to enable real-time, multijurisdictional data sharing. These tools will transform how infectious disease data is shared and analyzed, leading to better monitoring of dangerous pathogens.



Vineland Research and Innovation Centre: Partnering for Genomic Applications



Discovering the Science of Flavour

Tomatoes are the essence of summer in a bite. They are also responsible for more than half a billion dollars in annual farm sales and are Canada's biggest fresh vegetable export. Vineland Research and Innovation Centre is working with **Dr. Charles Goulet** of *Université Laval* to ensure new tomato varieties possess something very important to the consumer – flavour. The development of flavourful tomato cultivars will give Canadian greenhouse producers an advantage in a competitive market, with total direct economic benefits estimated at more than \$30 million per year.

Strengthening Canada's Greenhouse Vegetables

Canada's greenhouse industry generates more than \$1 billion a year. In a competitive environment, plant diseases are an enormous burden on growers, causing up to 20% crop loss. **Dr. David Guttman, Dr. Darrell Desveaux, and Dr. Adam Mott** of the University of Toronto have discovered a family of genes that allow plants to be resistant against damaging bacteria and fungi. The team is working with the Vineland Research and Innovation Centre to further develop these genes to protect greenhouse crops against multiple pathogens, ultimately reducing losses and increasing yields.



In Review

INTRODUCTION

This year saw Genome Canada achieve significant highlights, launch exciting new projects, and make considerable progress towards its objectives. As you will read in this annual report, in 2018-19 Genome Canada supported research projects totalling \$182.3 million including support from federal, provincial, industrial and other sources. The Genome Canada model involves cooperation and collaboration with six independent Genome Centres: Genome Atlantic, Génome Québec, Ontario Genomics, Genome Prairie, Genome Alberta, and Genome British Columbia. Together, Genome Canada and the Centres constitute Canada's Genomic Enterprise, working together to align federal and provincial strategy and funding and working proactively to build exceptional interdisciplinary teams focused on putting genomics into the hands of those who will use it.

WE LAUNCHED OR CONTINUED:

- 25 projects in our Bioinformatics and Computational Biology program
- Seven new projects in our Disruptive Innovations in Genomics program
- 11 new projects in the Genomic Applications Partnership Program (GAPP)
- 15 projects from the 2017 Large-Scale Applied Research Project Competition in Genomics and Precision Health
- A new competition in Agriculture, Agri-Food, Fisheries and Aquaculture, co-funded by Agriculture and Agri-Food Canada (AAFC)
- An important new initiative in Precision Health and Rare Diseases designed to move genomics into the clinic and making precision health more widely available for rare disease patients in Canada.
- Ongoing support for dozens of large-scale projects and industry partnerships designed to bring genomics into the hands of those who will use it
- National and international consultations in support of a new Strategic Vision for Genome Canada
- A new Equity, Diversity and Inclusion statement directed at diversifying Genome Canada's community
- A National Dialogue Series on genomics to engage Canadians in how advanced biosciences are impacting their lives
- Support for international initiatives like the Global Alliance for Genomics and Health and Divseek, as well as ongoing support for the Structural Genomics Forum



Genome Canada also collaborates and coordinates with partners across the ecosystem. We work closely with industry, government, users and other stakeholders to develop sector strategies for genomics, which inform our strategic direction in these sectors. We work closely in program delivery with partners like Agriculture and Agri-food Canada (AAFC), the Canadian Institutes of Health Research (CIHR), the Social Sciences and Humanities Research Council (SSHRC), the Canada Foundation for Innovation (CFI), Mitacs and many others.

Moreover, we gratefully acknowledge the support of the Government of Canada, whose funding supports our mission and is the lead investment in all our research projects and whose funding renewal of \$100.5 million in Budget 2019 will continue to support excellence in Canadian research, application and translation.

HIGHLIGHTS

Selected highlights from 2018-19 that illustrate Genome Canada's commitment to its mission include:

April 24, 2018

University of Guelph biologist Paul D.N. Hebert awarded the 2018 Dr. A.H. Heineken Prize for Environmental Sciences for his "pivotal contribution to developing a genetic barcode capable of classifying every biological species on Earth." Dr. Paul Hebert's international Barcode of Life project was supported for many years by Genome Canada and Ontario Genomics.

May 16, 2018

Genome Quebec launches a new online education platform for high-school students in the province. The platform was designed with teachers and academic advisors to teach basic concepts about genetics and genomics and meets provincial curriculum standards.

May 16, 2018

Memorial University of Newfoundland research team of Drs. Terry-Lynn Young, Sean Connors, Kathleen Hodgkinson and Daryl Pullman received a 2018 Governor General Innovation Award for identifying a lethal gene mutation known to have caused sudden cardiac death in more than 25 Newfoundland and Labrador families. Genome Canada is proud to have supported this exceptional work through The Atlantic Medical Genetic and Genomics Initiative, a collaboration with Genome Atlantic, launched in 2005-06.

June 4, 2018

Genome Canada launched a national precision health strategy to support better diagnostics and treatment for rare disease patients. By establishing shared and effective policies, processes, techniques and technologies, it will also form the first step towards a national roll-out of precision health for all Canadians.

September 19, 2018

Internationally-renowned plant geneticist Professor Pamela Ronald visits Vancouver to discuss plant genomics and the future of food as Genome BC's 9th annual Don Rix Distinguished Keynote speaker.

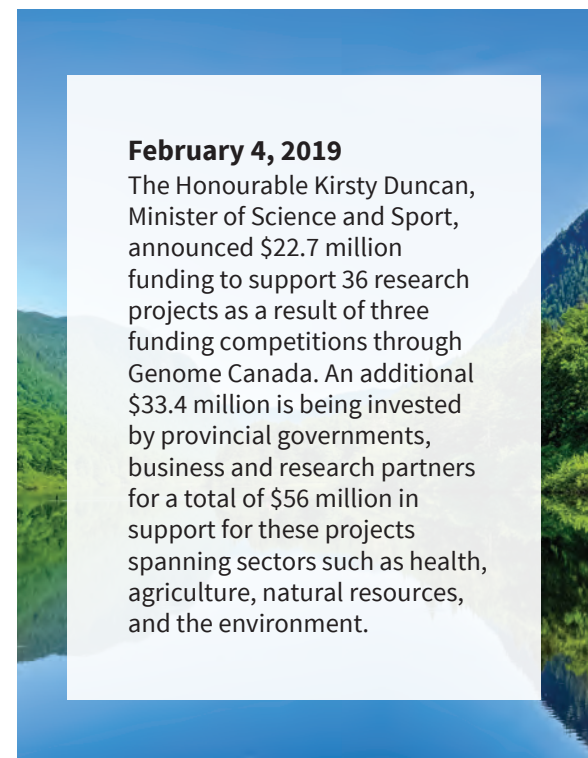


October 24, 2018

Canada's genomics community descended on Parliament for Genomics on the Hill – a celebration of genomics research and its impacts. Senator Rosa Galvez, Minister Kirsty Duncan and Parliamentary Secretary Kate Young greeted Parliamentarians, researchers, patients and guests and celebrated Canadian genomics research excellence.

December 2018

Genome Canada concludes an in-depth review of its integrated GE³LS research. Conducted by an expert panel led by Dr. Eric Meslin, the review strongly endorses integrated GE³LS as a component of Genome Canada's research portfolio and makes several suggestions for strengthening it.



February 4, 2019

The Honourable Kirsty Duncan, Minister of Science and Sport, announced \$22.7 million funding to support 36 research projects as a result of three funding competitions through Genome Canada. An additional \$33.4 million is being invested by provincial governments, business and research partners for a total of \$56 million in support for these projects spanning sectors such as health, agriculture, natural resources, and the environment.

February 7, 2019

Genome Atlantic supports the launch of an ambitious new project that applies genomics to the early detection and treatment of bipolar disorder, led by Drs. Martin Alda and Rudolf Uher.

February 14, 2019

Genome Canada launched the *Genomics in Society Interdisciplinary Research Teams* program, which aims to support and enhance GE³LS research that addresses challenges and/or accelerates the adoption and up-take of genomics research.



March 6-7, 2019

Ontario Genomics hosted the 2nd Annual Canada SynBio conference, focused on accelerating the growth and success of Canada's Engineering biology community. More than 300 researchers and innovators attended and a keynote was delivered by George Church.

March 19, 2019

The federal budget allocates an additional \$100.5 million over two years to Genome Canada to make "transformative scientific breakthroughs and translate these discoveries into real-world applications".



March 21, 2019

Genome Prairie launches Genome360, an initiative to make genomics and phenomics capabilities more accessible to Manitobans. It includes an electric-powered Molecular Biology Interactive Learning Enterprise (MOBILE) lab that takes a fully functional lab into the field.

PURSuing OUR OBJECTIVES

Genome Canada brings the power of genomics to Canadians in sectors of the economy as diverse as health, natural resources, agriculture and the environment. We continue to adapt our suite of programs to support an evolving national and global bioeconomy. Our work continues to be supported by strong levels of co-funding from partners in the public, private and not-for-profit sectors. Together we are driving innovation in the Canadian economy, resulting in job creation, growth, and improved prosperity.

THIS WORK IS DRIVEN BY OUR KEY CORPORATE OBJECTIVES, WHICH AIM TO:

- **Respond** to societal needs by generating genomics discoveries and accelerating their translation into applications;
- **Enhance** the impact of genomics by transforming knowledge of the ethical, environmental, economic, legal and social challenges and opportunities (GE³LS) into sound policies and practices; and,
- **Attract** greater investment in genomics research from a broad range of stake-holders, in particular the private sector;
- **Enhance** the recognition of the value of genomics by increasing stakeholder appreciation of genome science, its applications and implications.

These objectives have been met through a variety of programs, initiatives and corporate activities, described below. Genome Canada is proud of the excellence of Canada's researchers, the potential for their research ideas, and the opportunity to effect significant change in Canadians' health, wealth and environment. Genome Canada mitigates a few ongoing challenges, in particular the challenge of irregular and unpredictable funding, which makes long-term strategic planning difficult with stakeholders like provincial governments; increased demand, in particular for industry-linked partnership projects in our GAPP program; and the need to increase engagement with stakeholders, users and the public to provide trusted, evidence-based information about newly emerging technologies and applications like gene editing, synthetic biology and precision health.

Genome Canada research projects are selected via world-class, international peer review. Reviewers are chosen for their recognized expertise in the science, technology and/or translation arena, and management of large-scale genomics projects. Reviewers are drawn primarily from the international scientific

Large-scale research projects



community. This ensures that the research we fund is of the highest international standards and avoids conflict of interest. Over the past year, Genome Canada recruited 138 reviewers from 11 countries. Genome Canada's board of directors makes the final decision on which applications to fund, based on recommendations received from the international panel of reviewers.

The foundation of Genome Canada's research portfolio is the Large Scale Applied Research Project Program, which supports ambitious, interdisciplinary applied research aimed at putting genomics into the hands of those who will use it. These projects are selected via sector-based competitions involving a highly-competitive peer review process. Each project must include an integrated GE³LS component to help promote the use of genomic-based research and innovation—in particular to investigate key factors that may facilitate or hinder the effective translation of research and the uptake of genomic-based applications. Finally, these projects are co-funded by provincial governments, industry or other users and partner organizations at a rate of at least 1:1 versus federal dollars.

This year saw the launch of 15 successful projects from the **2017 LSARP Competition in Genomics and Precision Health**. These projects, co-funded with CIHR are expected to improve health outcomes and/or enhance the cost-effectiveness of the health-care system. A broad range of projects and research leaders were funded (a full list and descriptions are [here](#)). Projects include:

- **Dr. Laura Arbour** (University of British Columbia), **Dr. Nadine Caron** (University of British Columbia), **Dr. Wyeth W. Wasserman** (BC Children's Hospital Research Institute). The project Silent Genomes is designed to address barriers to the growing genomic health divide between Indigenous populations and other Canadians.
- **Dr. Ian Lewis** (University of Calgary) and **Dr. Deirdre Church** (Calgary Laboratory Services). This project is designed to reduce the global burden of infectious diseases and anti-microbial resistance through a new Precision Infection Management strategy designed to match appropriate antibiotic use with individual patients.
- **Dr. Alain Stintzsi** (University of Ottawa) and **Dr. David Mack** (Children's Hospital of Eastern Ontario). A project designed to identify, characterize and quantify the gut microbiome associated with treatments for Inflammatory Bowel Disease (IBD) in order to personalize treatment plans.
- **Dr. Nada Jabado** (Research Institute of the McGill University Health Centre), **Dr. Michael Taylor** (SickKids), **Dr. Jacek Majewski** (McGill University). This project will build on early work that pediatric brain tumours are driven by mutations in brain devel-



opment genes, and will fast track treatments targeting specific genetic alterations early at diagnosis.

This year also saw the launch of the **2018 LSARP Competition: Genomic Solutions for Agriculture, Agri-food, Fisheries and Aquaculture**. This \$76 million competition, including co-funding, was launched in June 2018 in partnership with AAFC. It supports projects that demonstrate how genomics research can be translated into solutions advancing the sustainability, productive capacity and competitive position of the Canadian agriculture/agri-food and fisheries/aquaculture sectors. Research in these areas has the potential to provide new approaches that can improve disease and pest resistance in our crops, livestock, and fish, increase our understanding of soil and aquatic microbiomes, improve early disease detection in livestock, improve our ability to track, monitor and assess wild fish populations, and identify crops and livestock that are more resilient to temperature extremes due to climate change. 73 pre-applications were received in November 2018. 27 applicants were invited to submit full proposals which will be reviewed and evaluated during in-person sessions in June 2019.



Genome Canada continued to support successful projects from previous LSARP competitions, particularly the [2015 LSARP Competition in Natural Resources and the Environment](#), and the [2014 LSARP Competition for Genomics and Feeding the Future](#). As with all LSARP projects, Genome Centres monitor projects via Research Oversight Committees, who report on progress being made and who make recommendations regarding continued funding while providing the project team advice and guidance to help ensure that the project achieves its stated objectives and milestones.



In 2018-19, Genome Canada also introduced an initiative called the [Regional Priorities Partnership Program \(RP3\)](#). RP3 projects are identified by regional Genome Centres in conjunction with their provincial partners, aggregating efforts in a coordinated national way but also partnering locally on issues important to individual regions. These strategic investments support strong federal-provincial alignment on research priorities and support capacity-building and development across Canada. Over \$16.6M of federal, provincial and other funding has been allocated to the program to support the following projects:

- Advancing environment genomics in the marine environment (Atlantic Canada)
- BIONET Alberta: A Bioinformatics Network for the Province of Alberta (Alberta)
- Development of genomic tools for the vaccination and breeding of cleaner fish (lumpfish and cunner) in support of the aquaculture industry (Newfoundland and Labrador)
- Early detection and treatment of a bipolar disorder (Nova Scotia)
- Enhancing Fusarium head blight resistance in durum wheat (Saskatchewan)
- Implementation of a modern and sustainable mussel breeding program (Prince Edward Island)
- Improving cannabis productivity and strain identification (New Brunswick)
- Ontario Regional Priorities Program in Agriculture and Agri-food (Ontario)
- Provincial platform to meet clinical genomics needs (Manitoba)
- Regional Priority on Pathogen Control (British Columbia)

Genome Canada also continues to support the international collaborations through the ERA-NET consortium “E-Rare-3” and the “European Research Projects on Rare Diseases” joint transnational call, [launched in 2015](#). Nine projects with Canadian participants are ongoing through this joint international funding mechanism.

Increasingly, genomics research is moving toward application and implementation. As such, there is greater demand for projects designed to bring research into the clinic or field or factory. Genome Canada’s flagship partnership program is the **Genomics Applications Partnership Program (GAPP)**. A total of \$207.4 million, including co-funding, has been invested in 54 receptor-led projects to date.

Translating research into application



In addition to launching four new GAPP competitions, two cycles of GAPP projects, the 9th and 10th rounds, were made official this year. Minister of Science and Sport Kirsty Duncan announced the successful recipients of the GAPP 9 project at **Vineland Research and Innovation Centre**, whose researcher **Dr. Michael Pautler** is collaborating with **Dr. David Guttman and his team at the University of Toronto** to improve disease-resistance in greenhouse vegetables. Their work will help reduce the 20% crop loss and improve Canada’s greenhouse industry, currently worth more than \$1 billion in retail sales and exports annually. Descriptions of the GAPP 9 projects can be found [here](#).

GAPP 10 featured several innovative partnerships, including a collaborative research project between the **World Wildlife Fund Canada (WWF-Canada)**, **Dr. Mehrdad Hajibabaei from the University of Guelph and Environment and Climate Change Canada (ECCC)**. They will validate and implement a new technique called environmental DNA metabarcoding, which uses bulk environmental samples for identification of species through species specific genomic sequences (DNA 'barcodes') using high-throughput sequencing technologies. The project will generate biodiversity data for freshwater benthic macroinvertebrates, the small animals that live at the bottom of streams, rivers. The technique will be used to analyze bulk samples collected by community-based monitoring efforts across a wide range of Canadian watersheds. This project will be the first of its kind at this scale and will help understand the impacts of resource projects





like mines, hydro dams or changing climate. Descriptions of the GAPP 10 projects can be found [here](#).

Several of the GAPP projects benefit from **Genome Canada's partnership with Mitacs**, a not-for-profit organization that supports industrial research internships for graduate students at Canadian universities. Additional support from Mitacs provides trainees the opportunity to spend time on-site with industrial research partners, gaining work-integrated-learning and building networks outside academia to support their professional skills development. These internships also strengthen the collaboration between academic researchers and industrial partners on GAPP projects.

Successful translation of research into application often involves complex ethical, environmental, economic, legal and social issues, which Genome Canada addresses through GE³LS research. In addition to the integrated GE³LS research include in every LSARP project, Genome Canada supports stand-alone GE³LS research projects. This year, Genome Canada launched the **Genomics in Society Interdisciplinary Research Teams (GiSIRT)** program. This program is meant to facilitate collaborations and dialogue among GE³LS researchers and other key stakeholders to ensure productive and responsible translation of innovative genomics applications. The call for proposals was launched this year, and projects will begin in spring 2020.

Cutting-edge technologies

Genomics technology platforms form the backbone of Canada's genomics infrastructure. Ten **Genomics Technology Platforms** are being supported for a total of up to \$150 million, including co-funding, over five years, beginning in April 2017. The technology platforms provide the research community with the highest-quality 'omics technologies and advice. Each of the platforms provides researchers access to high throughput 'omics technologies such as DNA sequencing, proteomics and metabolomics. The platforms also provide researchers with new method and protocol development, data analysis and bioinformatics. These platforms are co-funded by provincial governments through the Genome Centres and through **Canada Foundation for Innovation (CFI)**.

Genome Canada supports the development of the next generation of technologies through a technology-development program, **Disruptive Innovation in Genomics (DIG)**. This program supports Canadian research to adapt, adopt, and develop new approaches to support and complement current technologies available to the Canadian research community. This year, Genome Canada invested \$19.1 million with co-funding partners

The Genomics Technology Platforms supported are:

- The Proteomics Centre, Victoria, British Columbia
- BC Cancer Agency Genome Sciences Centre, Vancouver, British Columbia
- The Metabolomics Innovation Centre, Calgary, Alberta
- The Centre for Applied Genomics, Toronto, Ontario
- Network Biology Collaborative Centre, Toronto, Ontario
- Canadian Data Integration Centre, Toronto, Ontario
- McGill University and Genome Quebec Innovation Centre, Montreal, Quebec
- Centre for Advanced Proteomic and Chemogenic Analyses, Montreal, Quebec
- Canadian Centre for Computational Genomics, Montreal Quebec and Toronto, Ontario

in seven projects (described [here](#)). These projects included cutting-edge projects like the one led by **Dr. David Juncker at McGill University** to develop techniques to analyze single exosomes – tiny droplets secreted by cells that can be used as fingerprints for cancer cells, with the potential to transform the cancer diagnostics market.

Genomics is being transformed by enormous quantities of data available through increased sequencing activity, creating opportunities and challenges in the area of bioinformatics and computational biology. This year, Genome Canada awarded a total of \$23.1 million to 25 projects in the Bioinformatics and Computational Biology competition, designed to produce next-generation tools and technologies to take advantage of these large data sets (project descriptions provided [here](#)). A project led by **Dr. Paul Stothard at the University of Alberta** and **Dr. Gary van Domselaar of the Public Health Agency of Canada** are developing software that will allow non-bioinformatics researchers to convert raw bacterial sequence data into high-quality, richly described, and easily interpreted whole-genome assemblies that will be much more easy to apply to their research programs. **Dr. Leonid Chindelevitch** and **Dr. Maxwell Libbrecht of Simon Fraser University** are collaborating with Jesse Shapiro of the University of Montreal to develop computational tools based on artificial intelligence and machine learning, which will be able to unravel the complex relationships between bacterial genome sequences and antibiotic resistance.





Partnerships



Genome Canada is built on partnerships. The organizational model encourages partnership between the federal government and provincial governments as represented by the Genome Centres – and reflected in the co-funding model for all Genome Canada projects. Beyond this, nearly every Genome Canada project involves partnership with user groups, patient advocates, industry, the public sector, or other receptors; Genome Canada believes that working together and bringing different perspectives is key to producing useful innovation.

Genome Canada works closely with other Canadian research organizations to develop and deliver programs and activities. This year, Genome Canada collaborated and co-funded projects with national research organizations including **CIHR**, **SSHRC**, **CFI**, **CIFAR**, **AAFC**, and **Mitacs**. Through the Genome Centres, Genome Canada also cooperates with provincial and regional organizations across the country.

International Leadership



Genome Canada is responsible for ensuring that Canada benefits from international initiatives in genomics and is contributing to international efforts to solve global problems. As such, Genome Canada maintains close relations with its counterparts around the world and is in regular contact to share progress and ideas and to identify possible avenues for collaboration. For instance, Genome Canada regularly attends international meetings on precision health, genomics and the environment, anti-microbial resistance, agriculture, etc. Additionally, Genome Canada encourages its researchers to participate in global initiatives and to include international collaborators on Genome Canada-funded projects.

Genome Canada also provides funding to promote Canadian leadership on international initiatives of particular importance or value to Canada. For many years, Genome Canada has been a core supporter of the **Structural Genomics Consortium (SGC)**, an internationally-recognized initiative headquartered in Toronto. Established in 2004, the SGC has been a global leader the discovery of new medicines through open access research and public-private partnerships. Throughout 2018-19, Genome Canada continued its investment in the SGC. Nearly \$400 million in investments have been made in collaboration with partners since 2004 in the SGC.

This year, Genome Canada supported the leadership teams of two major international initiatives. **The Global Alliance for Genomics and Health (GA4GH)** has over 500-member organizations from 71 countries focused on improving human health through global genomics and clinical data sharing. Canada is now playing a significant leadership role in establishing international standards around data governance, trust and privacy as well as technical standards for genomic health data. Through GA4GH, ‘Driver Projects’ have become key delivery agents in bringing data sharing infrastructure to life. Since 2017 and thanks to Genome Canada’s support of GA4GH, Canada has played a role in several ‘Driver Projects’, which help identify, develop and pilot data sharing frameworks and standards in the near term in real-world settings.

DivSeek is an international collaboration that enables researchers and breeders to mobilize the genetic variation found in the world’s gene banks to accelerate the rate of crop breeding and to enhance the productivity, sustainability, and resilience of crop varieties to challenges such as climate change. Genome Canada will provide approximately \$250,000 over three years in support of the DivSeek International Network (DIN) secretariat based at, and co-funded by, the Global Institute for Food Security in Saskatoon. Genome Canada believes in facilitating access to user-friendly bioinformatics tools and cyberinfrastructures to handle the datasets and complex analysis that will facilitate innovation in crops

and is investing \$250,000 in a project entitled DivSeek Canada to help accelerate plant breeding by leveraging the genetic diversity in the world's live collections and seed banks to create a unified, coordinated and cohesive information management platform. This type of innovation in crops is of importance to Canada's agriculture sector in meeting the challenge of global food security in the face of population growth, changing the climate, and increasing constraints on land, water, and fertilizer.

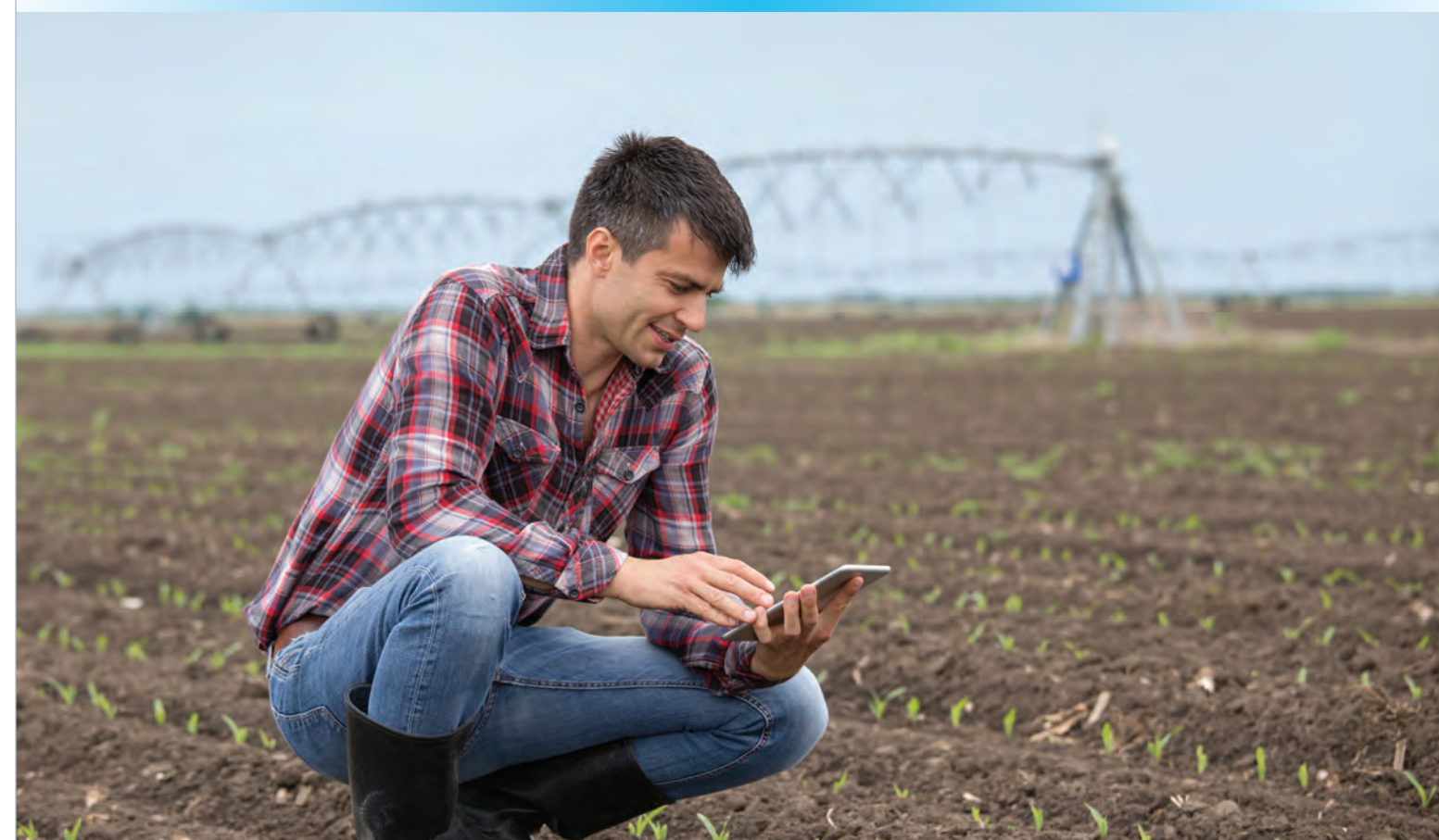
Increasing stakeholder appreciation of genomics



As part of its mandate to increase uptake and application of genomics, Genome Canada works to increase stakeholder understanding of genomics and appreciation for how it can be used. As such, Genome Canada regularly produces **sector strategies for genomics** – strategies that outline challenges and opportunities in sector-specific applications and identifies mechanisms to address them through research and innovation. Generally, Genome Canada convenes dialogues with key stakeholders from industry, academia, government and the not for profit sector to share ideas, identify opportunities and discuss collaborations, with Genome Canada acting as organizer and producer of the final report. This year, a sector strategy for agriculture, agri-food, fisheries and aquaculture was produced ahead of the LSARP competition in the same area. The final report is expected to be published in early 2019-20.

Genome Canada, along with other members of Canada's Genomic Enterprise, was a proud co-sponsor of **SynBio 2019**, an annual symposium coordinated and hosted by our partner Ontario Genomics. This event brings together researchers and industry for a two-day symposium designed to share information and identify opportunities to support this rapidly developing field. This year's event hosted at the **MaRS Discovery District** in Toronto, brought together more than 300 people, including researchers, policymakers, industry, entrepreneurs, start-ups, associations, funders, VCs and other from across Canada and beyond. SynBio has become the annual focus for conversations about synthetic biology in Canada.

This year also saw the release of a revitalized communications strategy designed to work with Genome Centres on outreach, engagement and communications around genomics and its impacts. This year, Genome Canada launched the **National Dialogue Series in Genomics**, a series of events across the country to engage with the public and other stakeholders. Events included a public lecture hosted by Genome Atlantic on the genomics of bipolar disorder led by **Dalhousie University researchers, Martin Alda and Rudolf Uher**, attended by roughly



100 researchers, patients and public in Halifax and a day-long symposium hosted by Genome Quebec in Montreal called **Êtes-Vous Génomique?** which brought together non-genomics experts from communications, policy and the public sphere to learn about genomics and discuss its implications in their space.

Genome Canada also ensures that it communicates to Parliamentarians and others in government who are responsible for making investments in genomic science. This year, Genome Canada hosted its Genomics on the Hill event where researchers had a chance to meet Parliamentarians and to share their stories and enthusiasm with public office holders and others in Ottawa. The event was hosted by Senator Rosa Galvez, an environmental engineer and friend of Genome Canada, and was attended by Minister Kirsty Duncan and Parliamentary Secretary Kate Young among many others. Researchers in attendance included **Dr. Richard Hamelin of the University of British Columbia** who demonstrated his hand-held device for doing in-field genetic identification of forest pests and **Dr. Curtis Pozniak of the University of Saskatchewan**, a leader in the global effort to sequence the immensely complicated wheat genome.



Other activities to reach out to stakeholders included participating or sponsoring events at the **Canadian Science Policy Conference, Scaling Up, BIO International, AESIS Impact of Science, Stand Up 2 Cancer, Gairdner Awards, Advancing Women in Agriculture Conference, Canadian Cancer Research Conference, Science Meets Parliament**, and others.

Corporate



On a corporate level, this was an exciting and important year for Genome Canada. Central to this year's activities was the development of a new Strategic Vision for the organization. The year included consultations with the genomics community from coast to coast, with over 300 people involved in interviews, roundtables and conversations about the future of genomics and Genome Canada. We spoke with researchers, users, federal and provincial government representatives to get a picture of where genomics is today, where it is going and how Genome Canada can best support Canadian research in the field. The resulting **Strategic Vision** will be an evergreen vision document with high-level objectives and shorter-term strategies that will be released in early 2019-20.

As part of this visioning exercise, Genome Canada also launched a **review of its integrated GE³LS program**. An independent panel of experts led by **Dr. Eric Meslin** on behalf of the Science and Industry Advisory Committee conducted interviews, looked at case studies and delivered a report with recommendations to the Board of Directors in December 2018. The report underscores the continued need for integrated GE³LS and points to its many strengths and successes while identifying important ways the program can be strengthened. The report is available on the Genome Canada website, and its recommendations are being implemented this year and in 2019-20.

Genome Canada was also pleased to work with Minister Duncan and other national research organizations to develop an **Equity, Diversity and Inclusion Action Plan**. Genome Canada acknowledges that equity, diversity and inclusion (EDI) strengthen the research ecosystem, enhance research quality, and increase the social relevance and impact of research and innovation. Genome Canada recognizes that challenges remain in achieving the full participation of underrepresented groups (including women, racialized and ethnic minorities, Indigenous peoples, people with disabilities and LGBTQ2+ people) in scientific careers and is committed to identifying and overcoming barriers that may exist within its own hiring process, programs, peer-review system, and governing bodies. Genome Canada has implemented an EDI policy and framework and is working to implement EDI principles throughout its calls for applications and funding guidelines.

To ensure that Genome Canada is aware of any EDI issues in its programming, the ability to capture EDI data is being built into the information management system that is currently under development within the organization. This will allow for competition and project level analysis on EDI components. Genome Canada also supports events that focus on underrepresented groups, including the Advancing Women in Agriculture Conference and the international Gender Summit.



Objectives for 2019-20

At a high level, Genome Canada continues to pursue the following objectives:

- **Respond** to societal needs by generating genomics discoveries and accelerating their translation into applications;
- **Attract** greater investment in genomics research from a broad range of stakeholders, in particular the private sector;
- **Enhance** the impact of genomics by transforming knowledge of the ethical, environmental, economic, legal and social challenges and opportunities (GE³LS) into sound policies and practices; and,
- **Enhance** the recognition of the value of genomics by increasing stakeholder appreciation of genome science, its applications and implications.

As Genome Canada finalizes and publishes its renewed Strategic Vision in 2019-20, these objectives will be refined and refreshed to capture the evolving nature of the organization.

ACTIVE PROJECTS FUNDED



Active Projects 2018-19

Large-scale science

CENTRES	SECTOR	LEADERS	ORGANIZATIONS	TITLE	TOTAL FUNDING	GENOME CANADA CONTRIBUTION
LARGE-SCALE APPLIED RESEARCH PROJECTS						
Genome Alberta Genome Prairie	Agriculture	Dyck, Michael Harding, John Kemp, Bob	University of Alberta	Application of Genomics to Improve Disease Resilience and Sustainability in Pork Production	\$9,801,714	\$3,799,998
Genome Alberta Ontario Genomics	Agriculture	Miglior, Filippo Stothard, Paul	University of Guelph	Increasing Feed Efficiency and Reducing Methane Emissions through Genomics: A new Promising Goal for the Canadian Dairy Industry	\$10,306,910	\$3,798,134
Genome British Columbia	Agriculture	Rieseberg, Loren Burke, John	University of British Columbia	Genomics of Abiotic Stress Resistance in Wild and Cultivated Sunflowers	\$7,879,009	\$3,054,485
Genome British Columbia Ontario Genomics	Agriculture	Foster, Leonard Zayed, Amro	University of British Columbia	Sustaining and Securing Canada's Honey Bees using 'Omic Tools	\$7,263,568	\$2,786,531
Genome Prairie	Agriculture	Bett, Kristin Vandenberg, Bert	University of Saskatchewan	Application of Genomics to Innovation in the Lentil Economy (AGILE)	\$7,892,793	\$1,463,833
Genome Prairie	Agriculture	Pozniak, Curtis Sharpe, Andrew	University of Saskatchewan	Canadian Triticum Applied Genomics (CTAG2)	\$8,809,640	\$1,707,991
Genome Prairie Genome British Columbia	Agriculture	Potter, Andrew Hancock, Robert	VIDO-Intervac University of Saskatchewan	Reverse Vaccinology Approach for the Prevention of Mycobacterial Disease in Cattle	\$7,358,606	\$2,872,310
Genome Québec	Agriculture	Belzile, François Bélangier, Richard	Université Laval	SoyaGen: Improving Yield and Disease Resistance in Short-Season Soybean	\$8,235,673	\$1,602,591
Genome Québec	Agriculture	Goodridge, Lawrence Levesque, Roger	McGill University	A Syst-OMICS approach to Ensuring Food Safety and Reducing the Economic Burden of Salmonellosis	\$9,708,401	\$3,817,861

CENTRES	SECTOR	LEADERS	ORGANIZATIONS	TITLE	TOTAL FUNDING	GENOME CANADA CONTRIBUTION
Genome Alberta Genome Atlantic	Energy	Gieg, Lisa Wolodko, John Khan, Faisal	University of Calgary	Managing Microbial Corrosion in Canadian Offshore and On-shore Oil Production Operations	\$7,850,739	\$2,307,750
Genome Alberta	Environment	McKenzie, Debbie Wishart, David	University of Alberta	Systems Biology and Molecular Ecology of Chronic Wasting Disease	\$11,500,523	\$3,092,335
Genome Alberta Genome Prairie	Environment	Hubert, Casey Stern, Gary	University of Calgary	GENICE: Microbial Genomics for Oil Spill Preparedness in Canada's Arctic Marine Environment	\$10,612,988	\$2,999,422
Genome British Columbia	Environment	Schulte, Patricia Koop, Ben Farrell, Anthony	University of British Columbia	Sustaining Freshwater Recreational Fisheries in a Changing Environment	\$4,386,173	\$1,460,163
Genome Québec	Environment	Sauvé, Sébastien Shapiro, Jesse Dorner, Sarah	Université de Montréal	ATRAPP - Algal Blooms, Treatment, Risk Assessment, Prediction and Prevention through Genomics	\$12,304,536	\$3,166,666
Genome Québec Genome Prairie	Environment	Basu, Niladri Hecker, Markus Crump, Doug	McGill University	EcoToxChip: A Toxicogenomics Tool for Chemical Prioritization and Environmental Management	\$9,786,922	\$3,104,002
Ontario Genomics	Environment	Lougheed, Stephen van Coeverden de Groot, Peter Whitelaw, Graham Dyck, Markus	Queen's University	BEARWATCH: Monitoring Impacts of Arctic Climate Change using Polar Bears, Genomics and Traditional Ecological Knowledge	\$9,219,247	\$2,708,282
Ontario Genomics	Environment	Warren, Lesley Banfield, Jillian	University of Toronto	Mine Wastewater Solutions: Next Generation Biological Treatment through Functional Genomics	\$3,682,691	\$1,181,739
Genome British Columbia Genome Québec	Fisheries	Koop, Ben Bernatchez, Louis	Simon Fraser University	Enhancing Production in Coho: Culture, Community, Catch (EPIC4)	\$9,709,592	\$3,796,910
Ontario Genomics	Fisheries	Walker, Virginia Lougheed, Stephen Schott, Stephan van Coeverden de Groot, Peter	Queen's University	Towards a Sustainable Fishery for Nunavummiut	\$5,652,792	\$2,124,674
Genome Alberta Genome British Columbia	Forestry	Thomas, Barb Erbilgin, Nadir El-Kassaby, Yousry	University of Alberta	Resilient Forests (RES-FOR): Climate, Pests & Policy - Genomic Applications	\$5,678,657	\$1,762,342
Genome British Columbia Genome Alberta	Forestry	Aitken, Sally Yeaman, Sam Hamelin, Richard	University of British Columbia	CoAdapTree: Healthy Trees for Future Climates	\$5,800,000	\$1,881,454
Genome British Columbia Genome Québec	Forestry	Bohlmann, Joerg Bousquet, Jean	University of British Columbia	Spruce-Up: Advanced Spruce Genomics for Productive and Resilient Forests	\$10,417,352	\$3,000,000
Genome British Columbia Genome Québec	Forestry	Hamelin, Richard Duff, Cameron Porth, Ilga	University of British Columbia	BioSurveillance of Alien Forest Enemies (BioSAFE)	\$8,730,760	\$2,763,989
Ontario Genomics Genome British Columbia	Forestry	Master, Emma Brumer, Harry	University of Toronto	SYNBIOMICS: Functional Genomics and Techno-Economic Models for Advanced Biopolymer Synthesis	\$10,725,222	\$2,830,781
Genome Alberta	Health	Lewis, Ian Church, Deirdre	University of Calgary Calgary Laboratory Services	Reducing the global burden of infectious diseases through precision population health	\$11,030,405	\$2,103,371
Genome British Columbia	Health	Penn, Andrew Borchers, Christoph Coutts, Shelagh	Vancouver Island Health Authority	Reducing Stroke Burden with Hospital-Ready Biomarker Test for Rapid TIA Triage	\$9,634,996	\$4,755,969
Genome British Columbia	Health	Carleton, Bruce C. Ross, Colin J.	University of British Columbia	Genomic and Outcomes Data-bank for Pharmacogenomic and Implementation Studies (Go-PGx)	\$10,517,507	\$1,899,963
Genome British Columbia	Health	Arbour, Laura Caron, Nadine Wasserman, Wyeth	University of British Columbia	Silent Genomes: Reducing health care disparities and improving diagnostic success for children with genetic diseases from Indigenous populations	\$10,399,812	\$2,200,000

Large-scale science

CENTRES	SECTOR	LEADERS	ORGANIZATIONS	TITLE	TOTAL FUNDING	GENOME CANADA CONTRIBUTION
Genome British Columbia	Health	Steidl, Christian Marra, Marco Scott, David	BC Cancer Research Centre	Deciphering the genome biology of relapsed lymphoid cancers to improve patient management	\$11,926,360	\$2,100,000
Genome British Columbia Genome Québec	Health	Elliott, Alison M. Knoppers, Bartha Lynd, Larry Austin, Jehannine	BC Provincial Health Services Authority	GenCOUNSEL: Optimization of Genetic Counselling for Clinical Implementation of Genome-wide Sequencing	\$4,237,284	\$1,004,017
Genome British Columbia Genome Québec Genome Alberta	Health	Keown, Paul Sapir-Pichhadze, Ruth Caulfield, Timothy Bryan, Stirling	University of British Columbia	Precision Medicine CanPRE-VENT AMR: Applying Precision Medicine Technologies in Canada to Prevent Antibody Mediated Rejection and Premature Kidney Transplant Loss	\$10,834,538	\$2,036,000
Genome British Columbia Ontario Genomics	Health	Turvey, Stuart Kobor, Michael Finlay, B. Brett Subbarao, Padmaja	University of British Columbia	Childhood Asthma and the Microbiome - Precision Health for Life: The Canadian Healthy Infant Longitudinal Development (CHILD) Study	\$9,142,486	\$4,569,644
Genome Québec	Health	Cossette, Patrick Michaud, Jacques Minassian, Berge	Centre hospitalier de l'Université de Montréal	Personalized Medicine in the Treatment of Epilepsy	\$11,509,053	\$5,585,410
Genome Québec	Health	Jabado, Nada Majewski, Jacek Pastinen, Tomi	McGill University Health Centre	The ICHANGE (International Childhood Astrocytomas iNtegrated Genomics and Epigenomics) Consortium	\$5,122,390	\$1,230,661
Genome Québec	Health	Perreault, Claude Roy, Denis-Claude	Université de Montréal	Personalized Cancer Immunotherapy	\$13,486,784	\$2,409,386
Genome Québec	Health	Rioux, John Bitton, Alain	Montreal Heart Institute	IBD Genomic Medicine Consortium (iGenoMed): Translating Genetic Discoveries into a Personalized Approach to Treating the Inflammatory Bowel Diseases	\$9,966,018	\$2,460,036
Genome Québec	Health	Rousseau, François Langlois, Sylvie	Université Laval	PEGASUS: Personalized Genomics for prenatal Aneuploidy Screening Using maternal blood	\$10,525,682	\$2,475,010
Genome Québec	Health	Sauvageau, Guy Hébert, Josée	Institute for Research in Immunology and Cancer	Innovative Chemogenomic Tools to Improve Outcome in Acute Myeloid Leukemia	\$11,325,631	\$4,908,515
Genome Québec	Health	Simard, Jacques Knoppers, Bartha Maria	Université Laval	Personalized Risk Stratification for Prevention and Early Detection of Breast Cancer	\$11,761,246	\$2,732,295
Genome Québec	Health	Sauvageau, Guy Hébert, Josée	Institute for Research in Immunology and Cancer	Interrogating and Implementing Omics for precision medicine in Acute Myeloid Leukemia	\$12,785,000	\$5,000,000
Genome Québec Genome British Columbia	Health	Rousseau, François Langlois, Sylvie	Université Laval	PEGASUS-2 - Personalized Genomics for prenatal Abnormalities Screening Using maternal blood: Towards First Tier Screening and Beyond	\$12,241,625	\$2,198,882
Genome Québec Ontario Genomics	Health	Simard, Jacques Chiarelli, Anna Maria	Université Laval	Personalized Risk Assessment for Prevention and Early Detection of Breast Cancer: Integration and Implementation	\$15,217,975	\$100,000

CENTRES	SECTOR	LEADERS	ORGANIZATIONS	TITLE	TOTAL FUNDING	GENOME CANADA CONTRIBUTION
Genome Québec Ontario Genomics	Health	Jabado, Nada Taylor, Michael Majewski, Jacek	Research Institute of the McGill University Health Centre	Tackling Childhood Brain Cancer at the root to improve survival and quality of life	\$12,997,397	\$2,349,822
Ontario Genomics	Health	Boycott, Kym MacKenzie, Alex	Children's Hospital of Eastern Ontario	Enhanced CARE for RARE Genetic Diseases in Canada	\$11,892,624	\$2,538,734
Ontario Genomics	Health	Scherer, Stephen Szatmari, Peter	The Hospital for Sick Children	Autism Spectrum Disorders: Genome to Outcomes	\$9,979,998	\$2,479,999
Ontario Genomics	Health	Stein, Lincoln Godfrey, Tony	Ontario Institute for Cancer Research	Early Detection of Patients at High Risk of Esophageal Adenocarcinoma	\$3,240,865	\$795,272
Ontario Genomics	Health	Stintzi, Alain Mack, David	University of Ottawa	The Microbiota at the Intestinal Mucosa-Immune Interface: A Gateway for Personalized Health	\$2,961,445	\$716,360
Ontario Genomics	Health	Stintzi, Alain Mack, David	University of Ottawa	Microbiome-Based Precision Medicine in Inflammatory Bowel Disease	\$9,111,566	\$4,555,624
Ontario Genomics	Health	Ratjen, Felix	The Hospital for Sick Children	Personalized Therapy for Individuals with Cystic Fibrosis	\$10,073,758	\$4,999,907
Ontario Genomics Genome Alberta	Health	Yeung, Rae S.M. Benseler, Susanne M.	The Hospital for Sick Children	UCAN CURE: Precision Decisions for Childhood Arthritis	\$10,000,000	\$5,000,000
Ontario Genomics Genome Alberta Genome British Columbia	Health	Boycott, Kym Brudno, Michael Bernier, Francois van Karnebeek, Clara	Children's Hospital of Eastern Ontario	Care4Rare Canada: Harnessing multi-omics to deliver innovative diagnostic care for rare genetic diseases in Canada (C4R-SOLVE)	\$10,866,640	\$2,198,898
EMERGING ISSUES						
Genome British Columbia	Agriculture	Rieseberg, Lorne	University of British Columbia	DivSeek Canada: Harnessing Genomics to Accelerate Crop Improvement in Canada	\$751,552	\$242,800
Genome Prairie	Health	Karnychuk, Uladzimir	University of Saskatchewan	In vivo and Ex vivo models for Zika virus infection	\$713,062	\$237,436
NATIONAL AND INTERNATIONAL INITIATIVES						
Genome Atlantic	Agriculture	Schnurr, Matthew	Dalhousie University	The GMO 2.0 partnership	\$199,966	\$99,983
Genome Prairie	Agriculture	Pozniak, Curtis	University of Saskatchewan	An integrated approach for enhancing Fusarium head blight resistance in durum	\$1,475,000	\$475,000
Genome Prairie	Environment	Clark, Douglas A.	University of Saskatchewan	Transforming Arctic Conservation through Social Innovation	\$199,850	\$99,925
Ontario Genomics	Environment	Beauchamp, Jonathan	University of Toronto	Genetic and environmental influences on economic preferences and outcomes	\$90,148	\$45,074
Genome Alberta Genome Québec	Health	McCabe, Christopher Rousseau, François	University of Alberta	Genomics and Personalized Health GE ³ LS Network program	\$1,996,945	\$998,473
Ontario Genomics Genome Alberta	Health	Dirks, Peter Weiss, Samuel	The Hospital for Sick Children	Brain Cancer Stem Cell Dream Team	\$10,577,948	\$8,500,000
Genome Atlantic	Health	Joly, David Filion, Martin	Université de Moncton	TRICHUM: Translating Research into Innovation for Cannabis Health at Université de Moncton	\$1,227,800	\$200,000
Genome Atlantic	Health	Alda, Martin Uher, Rudolf	Nova Scotia Health Authority Dalhousie University	Early detection of bipolar disorder and optimized selection of long term treatment	\$974,996	\$199,996
Genome British Columbia	Health	Sanatani, Shubhayan	BC Children's Hospital	Improving Diagnosis and Treatment of Catecholaminergic Polymorphic Ventricular Tachycardia	\$4,640,290	\$333,000
Ontario Genomics	Health	Brudno, Michael	The Hospital for Sick Children	Harmonising Phenomics Information for a Better Interoperability in the RD Field	\$4,429,833	\$333,000

Large-scale science

CENTRES	SECTOR	LEADERS	ORGANIZATIONS	TITLE	TOTAL FUNDING	GENOME CANADA CONTRIBUTION
Ontario Genomics	Health	Diamandis, Eleftherios	University of Toronto	Netherton Syndrome: From Mechanisms to Therapies	\$4,358,669	\$333,000
Ontario Genomics	Health	Edwards, Aled Arrowsmith, Cheryl	University of Toronto	Structural Genomics Consortium IV	\$51,182,671	\$12,499,998
Ontario Genomics	Health	Goodhand, Peter	Ontario Institute for Cancer Research	Canadian Genomics Partnership for Rare Disease	\$244,000	\$244,000
Ontario Genomics	Health	Stein, Lincoln	University of Toronto	Advancing Big Data Science in Genomics Research Project - The Cancer Genome Collaboratory	\$5,999,860	\$2,000,000
Ontario Genomics	Health	Gattinger, Monica	University of Ottawa	@Risk: Strengthening Canada's Ability to Manage Risk	\$195,166	\$97,583
Ontario Genomics	Health	Sargent, Ted	University of Toronto	Bio-inspired Solar Energy Network	\$500,000	\$250,000
Ontario Genomics	Health	Duggan, Ana	McMaster University	Jenner's Legacy: uncovering the origins and dissemination of smallpox vaccines in the 19th-20th centuries	\$48,030	\$24,015
Genome Alberta	Health	Goodman, Karen	University of Alberta	Developing Collaborative Research to Identify the Impacts of Helicobacter Pylori Genomics Research on Northern Canadian Indigenous Communities	\$75,000	\$37,500
Genome British Columbia	Health	Finlay, Brett Rossant, Janet	University of British Columbia	Canadian Humans and the Microbiome Program (CIFAR)	\$5,775,000	\$1,000,000
Genome Québec Ontario Genomics Genome British Columbia	Health	Knoppers, Bartha Maria Brudno, Michael Friedman, Jan	McGill University	Canadian International Data Sharing Initiative (CanSHARE)	\$3,287,331	\$1,000,000

Leading-edge technology

CENTRES	SECTOR	LEADERS	ORGANIZATIONS	TITLE	TOTAL FUNDING	GENOME CANADA CONTRIBUTION
CORE OPERATIONS SUPPORT FOR TECHNOLOGY PLATFORMS						
Genome Alberta Genome British Columbia	All	Wishart, David Borchers, Christoph	University of Alberta University of Victoria	The Metabolomics Innovation Centre	\$5,427,207	\$5,427,207
Genome British Columbia	All	Borchers, Christoph Foster, Leonard	University of Victoria University of British Columbia	The Pan-Canadian Proteomics Centre	\$5,518,555	\$5,518,555
Genome British Columbia	All	Marra, Marco Jones, Steven Nislow, Corey Hirst, Martin	BC Cancer Agency University of British Columbia	BC Cancer Agency Genome Sciences Centre Genomics Technology Platform	\$5,472,887	\$5,472,887

CENTRES	SECTOR	LEADERS	ORGANIZATIONS	TITLE	TOTAL FUNDING	GENOME CANADA CONTRIBUTION
Ontario Genomics	All	Awadalla, Philip Stein, Lincoln Ferretti, Vincent Simpson, Jared Bartlett, John	Ontario Institute for Cancer Research	Canadian Data Integration Centre	\$3,807,658	\$3,807,658
Genome Québec Ontario Genomics	All	Bourque, Guillaume Brudno, Michael	McGill University The Hospital for Sick Children	Canadian Centre for Computational Genomics	\$4,133,680	\$4,133,680
Genome Québec	All	Lathrop, Mark Pastinen, Tomi Ragoussis, Ioannis Bourque, Guillaume	McGill University	McGill University and Génome Québec Innovation Centre	\$5,505,600	\$5,505,600
Genome Québec	All	Thibault, Pierre Tyers, Michael	Université de Montréal	Centre for Advanced Proteomic and Chemogenomic Analyses	\$2,052,208	\$2,052,208
Ontario Genomics Genome Québec	All	McKerlie, Colin Vidal, Sylvia	The Hospital for Sick Children McGill University	The Centre for Phenogenomics	\$3,780,893	\$3,780,893
Ontario Genomics	All	Scherer, Stephen Strug, Lisa	The Hospital for Sick Children	The Centre for Applied Genomics	\$5,505,002	\$5,505,002
Ontario Genomics	All	Wrana, Jeff Gingras, Anne-Claude	Lunenfeld-Tanenbaum Research Institute Sinai Health System	Network Biology Collaborative Centre	\$3,016,310	\$3,016,310
GENOMICS INNOVATION NETWORK - TECHNOLOGY DEVELOPMENT PROJECTS						
Ontario Genomics	All	McKerlie, Colin	The Hospital for Sick Children	Toronto Centre for Phenogenomics	\$1,018,748	\$501,933
Ontario Genomics	All	Scherer, Stephen Strug, Lisa	The Hospital for Sick Children	The Centre for Applied Genomics	\$1,487,169	\$743,196
Ontario Genomics	All	Wrana, Jeff Gingras, Anne-Claude	Mount Sinai Hospital	Network Biology Collaborative Centre	\$905,892	\$452,360
GENOMICS INNOVATION NETWORK - COLLABORATIVE PROJECT						
Genome British Columbia	Health	Hirst, Martin	University of British Columbia	Canadian Epigenetics, Environment and Health Research Consortium Network	\$2,000,000	\$1,000,000
BIOINFORMATICS AND COMPUTATIONAL BIOLOGY						
Ontario Genomics	Agriculture	Provart, Nicholas	University of Toronto	ePlants Pipeline and Navigator for Accessing and Integrating Multi-Level Omics Data for 15 Agronomically-Important Species for Hypothesis Generation	\$250,000	\$250,000
Ontario Genomics	Agriculture	Provart, Nicholas	University of Toronto	Large Data Sets and Novel Tools for Plant Biology for use in International Consolidation and Tier Data Repositories and Portals	\$999,996	\$499,998
Genome Alberta	Agriculture	Stothard, Paul Van Domselaar, Gary	University of Alberta Public Health Agency of Canada	A comprehensive analytical toolkit and high-performance genome browser for rapid, reliable and in-depth characterization of bacterial genomes	\$940,977	\$458,368
Genome Atlantic Ontario Genomics	Agriculture	Beiko, Rob McArthur, Andrew	Dalhousie University	Rapid prediction of antimicrobial resistance from metagenomics samples: data, models, and methods	\$1,398,943	\$499,051
Genome Québec	Agriculture	Diallo, Abdoulaye Baniré Sirard, Marc-André	Université du Québec à Montréal Université Laval	Bioinformatics and Artificial Intelligence to leverage predictive models of dairy production	\$1,004,258	\$499,070
Genome Québec	Agriculture	Butler, Gregory	Concordia University	TooT Suite: Prediction and classification of membrane transport proteins	\$600,000	\$300,000
Genome British Columbia	Agriculture	Hsiao, William Van Domselaar, Gary	University of British Columbia Public Health Agency of Canada	Bioinformatics Tools to Enable Federated, Real Time Genomic Epidemiology Data Sharing and Analysis in a One Health Framework	\$1,164,488	\$500,000

Leading-edge technology

CENTRES	SECTOR	LEADERS	ORGANIZATIONS	TITLE	TOTAL FUNDING	GENOME CANADA CONTRIBUTION
Genome Québec	Environment	Xia, Jianguo Basu, Niladri	McGill University	Development and Validation of a Web-Based Platform for Environmental Omics and Toxicology	\$1,047,507	\$500,000
Ontario Genomics	Environment	Adamowicz, Sarah Hebert, Paul	University of Guelph	Extracting Signal from Noise: Big Biodiversity Analysis from High-Throughput Sequence Data	\$507,231	\$250,000
Genome British Columbia	Environment	Biol, Inanc	BC Cancer Agency	AnnoVis: Annotation and visualization of de novo genome and transcriptome assemblies	\$1,000,000	\$500,000
Genome British Columbia	Environment	Hallam, Steven	University of British Columbia	Global scale metabolic pathway reconstruction from environmental genomes	\$1,028,699	\$499,962
Ontario Genomics	Forestry	Provar, Nicholas Bohmann, Joerg	University of Toronto University of British Columbia	From ePlants to eEcosystems: New Frameworks and Tools for Sharing, Accessing, Exploring and Integrating 'Omic Data from Plants	\$1,000,000	\$499,999
Genome Atlantic Ontario Genomics	Health	Beiko, Rob McArthur, Andrew	Dalhousie University	Rapid Prediction of Antimicrobial Resistance from Metagenomics Samples: Data, Models and Methods	\$249,985	\$116,661
Genome British Columbia	Health	Biol, Inanc	BC Cancer Agency	New Bioinformatics for New Sequencing Technologies: Genome Characterization and Variation Detection using Long Reads	\$250,000	\$116,668
Genome British Columbia	Health	Brinkman, Ryan Chauve, Cedric Mostafavi, Sara	BC Cancer Agency	Automated Analysis of Big Flow Cytometry Data	\$249,994	\$118,762
Genome British Columbia	Health	Chindelevitch, Leonid Hsiao, William Chauve, Cedric	Simon Fraser University	PathOGIST: Calibrated Multi-Criterion Genomic Analysis for Public Health Microbiology	\$250,000	\$116,668
Genome British Columbia	Health	Borchers, Christoph Mohammed, Yassene	University of Victoria	Proteogenomics-Improved and -Guided Quantification Pipeline (PIGQpipe): Targeted Proteomics with Internal Proteogeno-typic Peptide Standards to Quantify Variants Identified by Proteogenomic Experiments	\$556,472	\$273,860
Genome British Columbia	Health	Chindelevitch, Leonid Libbrecht, Maxwell Shapiro, Jesse	Simon Fraser University Université de Montréal	Machine learning methods to predict drug resistance in pathogenic bacteria	\$1,000,000	\$499,886
Genome British Columbia	Health	Foster, Leonard Wishart, David	University of British Columbia University of Alberta	Illuminating the dark matter of the metabolome with convolutional neural networks	\$500,000	\$250,000
Genome British Columbia	Health	Joy, Jeffrey B. Montaner, Julio S.G.	University of British Columbia	Development and implementation of bioinformatics tools for HIV and HCV phylogenetic monitoring platforms	\$1,249,397	\$499,992

CENTRES	SECTOR	LEADERS	ORGANIZATIONS	TITLE	TOTAL FUNDING	GENOME CANADA CONTRIBUTION
Genome British Columbia Ontario Genomics	Health	Hsiao, William McArthur, Andrew Brinkman, Fiona	University of British Columbia	Genomic Epidemiology Application Ontology (GenEpiO)	\$250,000	\$116,668
Genome British Columbia	Health	Wasserman, Wyeth	University of British Columbia	OnTarget: Big Data Informed Software for the Design of cis-Regulatory Regions Controlling Human Gene Expression	\$250,000	\$116,709
Genome Québec	Health	Major, François Duchaine, Thomas	Université de Montréal	Computation of Cell-Specific MicroRNA: Mrna Regulatory Networks Enable the Design of Efficient RNAi-based Therapeutics	\$250,000	\$116,668
Genome Québec	Health	Shapiro, Jesse Barreiro, Luis	Université de Montréal	A Toolkit for Genome-Wide Association Studies in Bacteria	\$250,000	\$116,668
Genome Québec	Health	Waldispuhl, Jerome Moitessier, Nicolas	McGill University	Computational Methods and Databases to Identify Small RNA-binding Molecules Regulating Gene Expression	\$249,999	\$116,868
Genome Québec	Health	Bourque, Guillaume Joly, Yann	McGill University	Epigenomics Secure Data Sharing Platform for Integrative Analyses (EpiShare)	\$1,000,000	\$500,000
Genome Québec	Health	Xia, Jianguo Bourque, Guillaume Jacques, Pierre-Etienne	McGill University Université de Sherbrooke	An integrative platform for metabolomics and systems biology	\$1,094,607	\$500,000
Genome Québec	Health	Blanchette, Mathieu Majewski, Jacek Waldispuhl, Jerome	McGill University	Bioinformatics tools for integrative 3D epigenomics	\$1,122,405	\$500,000
Genome Québec	Health	Greenwood, Celia Ouakacha, Karim	Lady Davis Institute for Medical Research Université du Québec à Montréal	Precision Medicine in Cellular Epigenomics	\$660,512	\$317,220
Genome Québec	Health	Najmanovich, Rafael	Université de Montréal	Next-generation molecular docking leveraging artificial intelligence techniques to understand large-scale ligand binding data sets	\$500,000	\$250,000
Genome Québec Genome Prairie	Health	Waldispuhl, Jerome Tremblay-Savard, Olivier	McGill University	Crowdsourcing Genomic Databases	\$250,000	\$116,668
Ontario Genomics	Health	Brudno, Michael Weksberg, Rebecca	The Hospital for Sick Children	EpigenCentral: Consolidated epigenetic landscape for congenital, developmental and childhood disorders	\$249,900	\$117,577
Ontario Genomics	Health	Boutros, Paul	Ontario Institute for Cancer Research	Enhanced and Automated Visualization of Complex Data	\$250,000	\$116,668
Ontario Genomics	Health	Ferretti, Vincent Stein, Lincoln	Ontario Institute for Cancer Research	Dockstore: A Platform for Sharing Cloud-Agnostic Tools with the Research Community	\$250,000	\$116,668
Ontario Genomics	Health	Poon, Art	Western University	Kamphir: A Versatile Framework to Fit Models to Phylogenetic Tree Shapes	\$205,365	\$91,033
Ontario Genomics	Health	Brudno, Michael Bader, Gary	University of Toronto	MedSavant: An integrative framework for clinical and research analysis of human genomes	\$998,546	\$499,273
Ontario Genomics	Health	Lerner-Ellis, Jordan Lebo, Matthew	Mount Sinai Hospital Brigham and Women's Hospital	Development of a unified Canadian clinical genomic database as a community resource for standardizing and sharing genetic interpretations	\$1,000,000	\$500,000
Ontario Genomics	Health	Simpson, Jared	Ontario Institute for Cancer Research	Rapid, Accessible Genome Assembly Using Long Read Sequencing	\$250,000	\$116,668
Ontario Genomics	Health	Boone, Charles Myers, Chad L.	University of Toronto University of Minnesota	BridGE-SGA: A novel computational platform to discover genetic interactions underlying human disease	\$990,910	\$494,552



Leading-edge technology

CENTRES	SECTOR	LEADERS	ORGANIZATIONS	TITLE	TOTAL FUNDING	GENOME CANADA CONTRIBUTION
Ontario Genomics	Health	Gingras, Anne-Claude Rost, Hannes	Lunenfeld-Tanenbaum Research Institute University of Toronto	Computational tools for Data-Independent Acquisition (DIA) for quantitative proteomics and metabolomics	\$1,000,000	\$500,000
Ontario Genomics	Health	Haibe-Kains, Benjamin	University Health Network	SYNERGx: A computational framework for drug combination synergy prediction	\$972,700	\$486,336
Ontario Genomics	Health	Ma, Bin Moran, Michael	University of Waterloo Hospital for Sick Children	Software for Peptide Identification and Quantification from Large Mass Spectrometry Data using Data Independent Acquisition	\$925,987	\$462,998
Ontario Genomics	Health	Pugh, Trevor Brudno, Michael	Princess Margaret Cancer Centre Hospital for Sick Children	CReSCENT: CanceR Single Cell Expression Toolkit	\$1,000,000	\$499,900
Ontario Genomics	Health	Stein, Lincoln Fiume, Mark	Ontario Institute for Cancer Research DNASTack	Dockstore 2.0: Enhancing a community platform for sharing cloud-agnostic research tools	\$875,269	\$437,610
DISRUPTIVE INNOVATION IN GENOMICS						
Genome British Columbia	All	Hof, Fraser	University of Victoria	A Chemo-Affinity Toolkit for Methylation Proteomics	\$238,800	\$238,800
Genome British Columbia	All	Shah, Sohrab Nielsen, Cydney	University of British Columbia	Reimagining Genome Browsing for the Era of Single Cell Genomics	\$250,000	\$250,000
Genome British Columbia	All	Wasserman, Wyeth	University of British Columbia	GNomics: Graphs 'N' Omics	\$250,000	\$250,000
Genome British Columbia	All	Borchers, Christoph Sickmann, Albert	University of Victoria	Replacing Immunoassays with MS-based Technology: Quantitative Proteomics Kits Enabling Deep Molecular Phenotyping of the Mouse	\$3,865,231	\$999,695
Genome British Columbia	All	Hansen, Carl	University of British Columbia	Next Generation Immune Profiling Technology based on Microfluidic Single Cell Analysis	\$2,993,509	\$991,185
Genome British Columbia	All	Marra, Marco Coope, Robin	BC Cancer Agency	Automated Tumour Pathology	\$409,858	\$101,559
Genome Québec	All	Lécuyer, Eric Blanchette, Mathieu Waldispühl, Jérôme	Institut de recherches cliniques de Montréal	The RNA Zipcode Discovery Pipeline: Emerging Tools for Targeting Therapeutic Molecules at Subcellular Resolution	\$3,164,100	\$999,997
Genome Québec	All	Juncker, David	McGill University	Single Exosome Multi-Omic Analysis	\$249,999	\$249,999
Genome Québec	All	Costantino, Santiago Kleinman, Claudia	McGill University	Laser Assisted Single-Cell Genomics	\$250,000	\$250,000
Genome Québec	All	Trifiro, Mark Kirk, Andrew	McGill University	Plasmonic PCR: Rapid Diagnostics through Plasmonics	\$249,976	\$249,976

CENTRES	SECTOR	LEADERS	ORGANIZATIONS	TITLE	TOTAL FUNDING	GENOME CANADA CONTRIBUTION
Genome Québec	All	Lécuyer, Eric Blanchette, Mathieu Waldispühl, Jérôme	Institut de recherches cliniques de Montréal	The RNA Zipcode Discovery Pipeline: Emerging Tools for Targeting Therapeutic Molecules at Subcellular Resolution	\$250,000	\$250,000
Genome Québec	All	Juncker, David	McGill University	Digital Omics of Single Exosomes	\$2,001,438	\$667,157
Genome Québec Ontario Genomics	All	Tyers, Michael Wright, Gerard	Université de Montréal	A Cell Microfactory Platform for in vivo Biosynthesis and Delivery of Genetically Encoded Natural Products and Synthetic Antibodies	\$249,358	\$249,358
Ontario Genomics	All	Boone, Charles Moffat, Jason	University of Toronto	AbSyn Technology for Identification of Synergistic Cancer Therapeutics	\$249,389	\$249,389
Ontario Genomics	All	Dowling, James Brudno, Michael	The Hospital for Sick Children	RNA-seq in Patient-Derived ex-vivo Models: Genetic Diagnostics beyond Whole Exomes	\$250,000	\$250,000
Ontario Genomics	All	Emili, Andrew	University of Toronto	Massively Parallel Single Molecule Protein Sequencing in Situ	\$250,000	\$250,000
Ontario Genomics	All	Figeys, Daniel Stinzi, Alain	University of Ottawa	RapidAIM: a High-Throughput Assay of Individual Microbiome	\$250,000	\$250,000
Ontario Genomics	All	Finan, Turlough	McMaster University	Development of Advanced Genetic Toolbox for Sinorhizobium Meliloti to Enable Genome Scale Engineering	\$250,000	\$250,000
Ontario Genomics	All	Krell, Peter Doucet, Daniel	University of Guelph	Cell Biosensors for Rapid Screening of Insect Attractants	\$233,901	\$233,901
Ontario Genomics	All	Scherer, Stephen Lok, Si	The Hospital for Sick Children	Economical High Throughput de novo Whole Genome Assembly	\$241,467	\$241,467
Ontario Genomics	All	Stagljär, Igor	University of Toronto	Development of SIMPL, a Novel Protein-Protein Interaction Assay based on Split Intein for Biomedical Research	\$250,000	\$250,000
Ontario Genomics	All	Tabard-Cossa, Vincent	University of Ottawa	Solid-State Nanopore-based Quantification of Low-Abundance Biomarkers	\$250,000	\$250,000
Ontario Genomics	All	Taylor, Michael Khokha, Rama	The Hospital for Sick Children	Functional Genomics in Human Cells for Drivers of Lethal Metastatic Human Cancers	\$250,000	\$250,000
Ontario Genomics	All	Wheeler, Aaron Kolomietz, Elena	University of Toronto	Development of a Digital Microfluidic Platform to Identify and Target Single Cells from a Heterogeneous Cell Population for Lyses in an Ultra-Low Volume	\$250,000	\$250,000
Ontario Genomics	All	Wilson, Michael Shlien, Adam	University of Toronto	SANGRE (Systematic Analysis of Blood Gene Regulation by Sequencing) – Bringing RNAseq to Clinical Diagnostics	\$249,934	\$249,934
Ontario Genomics	All	Sidhu, Sachdev	University of Toronto	Synthetic Inhibitors of Ubiquitin-Binding Cancer Targets	\$3,009,018	\$1,000,000
Ontario Genomics	All	Stagljär, Igor	University of Toronto	The Mammalian Membrane Two-Hybrid (MaMTH) Assay - an Advanced Proteomics Technology for Biomedical Research	\$3,034,211	\$1,000,000
Ontario Genomics	All	Figeys, Daniel Stinzi, Alain	University of Ottawa	RapidAIM: A technology to rapidly assess the effects of compounds on individual microbiomes	\$2,888,563	\$757,358
Ontario Genomics	All	Boone, Charles Moffat, Jason	University of Toronto	AbSyn Technology for Identification of Synergistic Cancer Therapeutics	\$2,719,453	\$896,331
Ontario Genomics	All	Shlien, Adam Dowling, James	Hospital for Sick Children	Beyond the Genome: Transcriptome Based Diagnostics for Rare Diseases and Cancer	\$2,999,944	\$999,419



Leading-edge technology

CENTRES	SECTOR	LEADERS	ORGANIZATIONS	TITLE	TOTAL FUNDING	GENOME CANADA CONTRIBUTION
Ontario Genomics	All	Stagljär, Igor	University of Toronto	Interactome mapping of disease-related proteins using split intein-mediated protein ligation (SIMPL)	\$2,223,117	\$741,039
Ontario Genomics	All	Wheeler, Aaron Kolomietz, Elena Chitayat, David	University of Toronto Sinai Health Systems	Development of a digital microfluidic platform to identify and target single cells from a heterogeneous cell population for lysis in an ultra-low volume for non-invasive prenatal diagnosis	\$3,002,971	\$1,000,000

Translation

CENTRES	SECTOR	LEADERS	ORGANIZATIONS	TITLE	TOTAL FUNDING	GENOME CANADA CONTRIBUTION
GENOMIC APPLICATIONS PARTNERSHIP PROGRAM						
Genome Alberta	Agriculture	Plastow, Graham Kemp, Robert	University of Alberta Genesis Inc.	Development of Genomic Crossbred Estimate Breeding Values to maximize profitability for Canadian pork producers	\$3,389,222	\$1,129,647
Genome Prairie	Agriculture	Yost, Christopher Whiting, Mike	University of Regina Lallemand Inc.	Improving on-seed survival and performance of legume inoculants using genome shuffling	\$427,491	\$142,491
Genome Québec	Agriculture	Labrie, Steve Duquenne, Manon	Université Laval Agropur Cooperative	A Metagenomic Approach to Evaluate the Impact of Cheese-making Technologies and Ripening Conditions on the Microbial Ecosystem of Premium Washed Rind Cheeses	\$742,679	\$247,472
Genome Québec	Agriculture	Tsang, Adrian Matzat, Paul	Concordia University Elanco Animal Health	Development and Commercialization of Next Generation Enzyme Supplement for Swine and Poultry	\$6,000,000	\$2,000,000
Genome Québec	Agriculture	Robert, Claude Sullivan, Brian	Université Laval Canadian Centre for Swine Improvement	Chips for Better Chops: Commercial Application of Genomics for Accelerated Swine Genetic Improvement	\$6,550,103	\$1,996,186
Genome Québec	Agriculture	Tsang, Adrian Matzat, Paul	Concordia University Elanco Animal Health Eli Lilly and Company	Lysozyme feed additives to improve gut health and productivity of food animals	\$6,000,000	\$2,000,000
Ontario Genomics	Agriculture	Baes, Christine Wood, Ben	University of Guelph Hybrid Turkeys, a Hendrix Genetics Company	Application of Genomic Selection in Turkeys for Health, Welfare, Efficiency and Production Traits	\$6,039,988	\$1,999,422
Ontario Genomics	Agriculture	Pauls, Peter Crisp, Matthew Gray, Benjamin	University of Guelph Benson Hill Biosystems	Increasing yield in Canola Using Genomic Solutions	\$3,682,897	\$1,147,374
Ontario Genomics	Agriculture	LaPointe, Gisele Pepe, Maria	University of Guelph Parmalat Canada	Translating OMICS for competitive dairy products	\$1,339,129	\$446,077

CENTRES	SECTOR	LEADERS	ORGANIZATIONS	TITLE	TOTAL FUNDING	GENOME CANADA CONTRIBUTION
Ontario Genomics	Agriculture	Guttman, David Paulter, Nicholas	University of Toronto Vineland Research and Innovation Centre	Broad-Range Disease Resistance in Greenhouse Vegetables	\$2,008,200	\$668,291
Ontario Genomics	Agriculture	Mubareka, Samira Qadir, Mohammad	University of Toronto Fusion Genomics	Pre-emergence surveillance for reportable influenza viruses at the human-animal interface	\$790,753	\$250,000
Ontario Genomics	Agriculture	Mallard, Bonnie Lohuis, Michael	University of Guelph The Semex Alliance	Translating High Immune Response (HIRTM) Genomics to Improve Beef Cattle Health and Welfare	\$1,617,164	\$538,601
Ontario Genomics Genome Québec	Agriculture	Goulet, Charles Liscombe, David	Université Laval Vineland Research and Innovation Centre	A Genetic Toolbox for Tomato Flavour Differentiation	\$1,804,643	\$601,533
Genome Atlantic Genome Alberta	Energy	Hubert, Casey MacDonald, Adam	University of Calgary Nova Scotia Department of Energy	Microbial Genomics for De-Risking Offshore Oil and Gas Exploration in Nova Scotia	\$4,886,764	\$1,597,843
Genome Prairie	Environment	Levin, David Ducharme, Shawna	University of Manitoba Composites Innovation Centre	Fibre Composite and Biomatrix Genomics (FiCoGEN) - Application to the Ground Transportation Industry	\$3,315,000	\$1,105,000
Genome Québec	Environment	Robert, Claude Rioux, Rejean	Université Laval Direction générale de la protection de la faune (Québec)	Use of genomics to manage and protect caribou populations	\$3,043,190	\$1,011,323
Ontario Genomics	Environment	Edwards, Elizabeth Dworatzek, Sandra	University of Toronto SiREM	Scale-up of Bioaugmentation Cultures and Development of Delivery Strategies and Monitoring Tools for Anaerobic Benzene and Alkylbenzene Bioremediation	\$952,497	\$317,422
Ontario Genomics	Environment	Hajibabaei, Mehrdad Hendriks, Elizabeth	University of Guelph World Wildlife Fund Canada	Assessing Freshwater Health Through Community Based Environmental DNA Metabarcoding	\$2,608,784	\$866,852
Ontario Genomics	Environment	Mahadevan, Radhakrishnan Lau, Kit	University of Toronto BioAmber	Genomics Driven Engineering of Hosts for Bio-Nylon	\$5,700,000	\$1,900,000
Genome Atlantic	Fisheries	Rise, Matthew Taylor, Richard	Memorial University EWOS Innovation	Integrated Pathogen Management of Co-Infection in Atlantic Salmon	\$4,533,102	\$1,509,113
Genome British Columbia	Forestry	Bohlmann, Joerg Russell, John H.	University of British Columbia British Columbia Ministry of Forests, Lands and Natural Resource Operations	Cedar Enhanced Durability and Resistance (CEDaR): Sustainability of Canada's Western Redcedar Forestry Sector	\$2,150,779	\$716,811
Genome Québec	Forestry	Bousquet, Jean Smith, Guy	Université Laval FP Innovations	Fact Tests for Rating and Amelioration of Conifers (FastTRAC)	\$3,364,420	\$1,122,043
Genome Alberta	Health	Lewis, Ian Church, Deidre	University of Calgary Calgary Lab Services	Device for the rapid detection of seven common bloodstream infections and assessment of antibiotic susceptibility	\$6,024,695	\$1,999,812
Genome British Columbia	Health	Carleton, Bruce Coté, Yvan	University of British Columbia Dynacare	Integrating Pediatric Pharmacogenomic Testing into the Canadian System	\$2,809,934	\$936,512
Genome British Columbia	Health	Rossi, Fabio Underhill, T. Michael	University of British Columbia AbCellera Biologics	Antibody Therapeutics for Duchenne Muscular Dystrophy	\$6,506,824	\$1,998,726
Genome Québec	Health	Bergeron, Michel Allibert, Patrice	Université Laval GenePOC Inc.	Expanding the Molecular Point-Of-Care Test Menu with Two Gram-Positive Cocci	\$5,711,781	\$1,740,577
Genome Québec	Health	Thibault, Pierre Dunyach, Jean-Jacques	Université de Montréal Thermo Fisher Scientific	Bridging the ProteoGenomics Gap for Personalized Medicine Using Transformative Mass Spectrometry Technologies	\$1,737,722	\$522,730
Genome Québec	Health	Goodyer, Paul Huertas, Pedro	McGill University Health Centre Eloxx Pharmaceuticals	Novel Aminoglycoside Readthrough Reaction for Nonsense Mutations	\$2,051,396	\$671,720

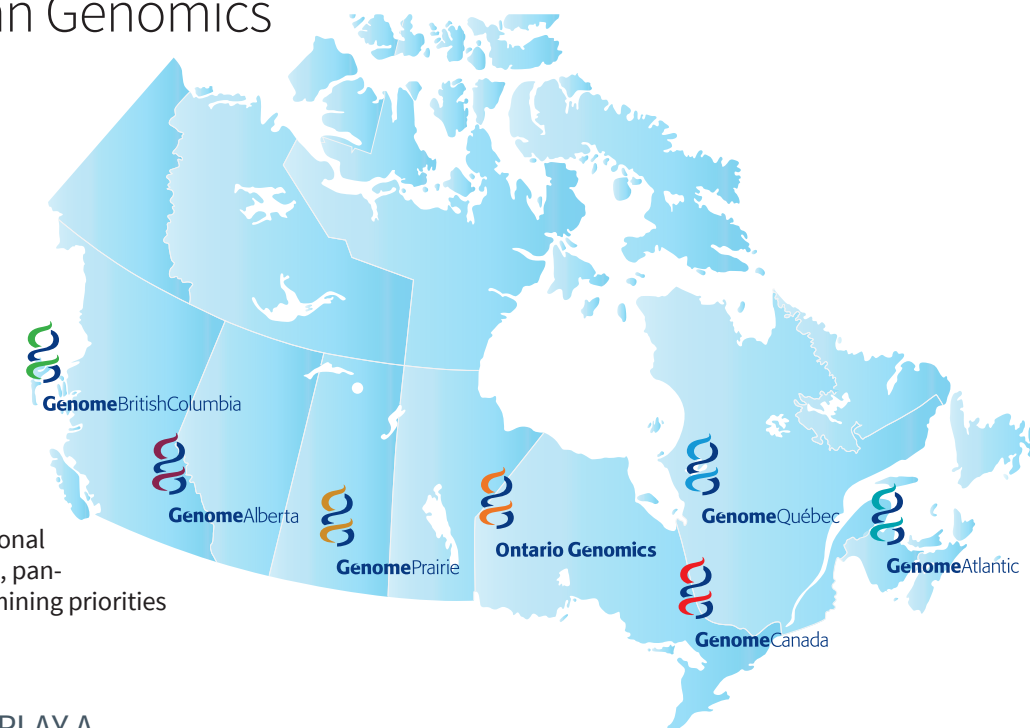


Translation

CENTRES	SECTOR	LEADERS	ORGANIZATIONS	TITLE	TOTAL FUNDING	GENOME CANADA CONTRIBUTION
Genome Québec	Health	Drouin, Régen Gao, Harry	Université Laval Fulgent Genetics	Development of comprehensive cytogenetics testing using an exome and low-pass whole genome sequencing combined approach	\$5,090,181	\$1,689,442
Genome Québec Genome British Columbia	Health	Borchers, Christoph Batist, Gerald Elvin, Paul	McGill University University of Victoria AstraZeneca	Second Generation Diagnostics: iMALDI-based Assays for Protein Activity to Improve Patient Selection for Therapeutic Akt Inhibitors in Cancer Treatment	\$3,340,335	\$806,285
Ontario Genomics	Health	Kennedy, James Altar, Anthony	Centre for Addiction and Mental Health Assurex Health Inc.	Clinical Utility and Enhancements of a Pharmacogenomic Decision Support Tool for Mental Health Patients	\$5,994,758	\$1,981,184
Ontario Genomics	Health	Liu, Peter Bucklar-Suchankova, Gabriela	University of Ottawa Heart Institute Roche Diagnostics International	Cardiovascular Biomarker Translation (CBT) Program	\$5,904,662	\$1,953,663
Ontario Genomics	Health	Wang, Jean Uger, Robert	University Health Network Trillium Therapeutics Inc.	SIRPaFc: Translating Genomics Research Into a Novel Cancer Immunotherapy	\$3,428,274	\$1,106,079
Ontario Genomics	Health	Kamel-Reid, Suzanne Sumner, Jeff	Princess Margaret Cancer Centre Lifelabs Medical Laboratory Services	Towards a National Framework for Cancer Genome Profiling in Canadian Hospitals	\$6,000,000	\$1,999,999
Ontario Genomics	Health	Keshavjee, Shaf Hartnett, Thomas	University Health Network United Therapeutics	Novel Rapid Diagnostic Tools for Lung Transplantation: Bringing Omics to the Bedside	\$6,000,000	\$2,000,000
Ontario Genomics	Health	Hawkins, Cynthia Saunders, Barney	The Hospital for Sick Children Nanostring Technologies	Clinical Development and Translation of Genomics-Driven Pediatric Cancer Diagnostics using NanoString Technology	\$1,865,739	\$600,000
Ontario Genomics	Health	Stewart, David Ivany, Craig	Ottawa Hospital Research Institute Eastern Ontario Regional Laboratory Association	Standardization of Molecular Diagnostic Testing for Non-small Lung Cancer	\$2,054,798	\$595,197
Ontario Genomics	Health	Lye, Steve Liu, Xin	Lunenfeld-Tanenbaum Research Institute BGI-Research	Leveraging Leukocytes as Endogenous Biosensors to Create Novel Diagnostics for Preterm Birth	\$4,565,893	\$1,503,307
Ontario Genomics	Health	Bramson, Jonathan Fiorino, Tony	McMaster University Triumvira Immunologics Inc.	Validation of TAC receptors for use against liquid and solid tumors	\$2,256,179	\$723,883
Ontario Genomics	Health	Kelley, Shana McInnes, Mark	University of Toronto Charlotte Products Ltd.	Devices for Detection and Identification of Surface Microbial Contamination in High-Risk Facilities	\$4,469,365	\$1,485,636
Ontario Genomics	Health	Bartlett, John Sadis, Seth	Ontario Institute for Cancer Research Thermo Fisher Scientific	Targeted Next Generation Sequencing Panels for Clinical Disease Management	\$6,000,000	\$2,000,000
Ontario Genomics	Health	Surette, Michael Magarvey, Nathan Haigh, Andrew	McMaster University Adapsyn Bioscience	Applying the Adapsyn Genomics Platform to the Identification, Isolation, and Characterization of Immune Modulators from the Human Microbiome	\$6,034,102	\$1,990,459

The Canadian Genomics Enterprise

Genome Canada operates within a unique and highly effective model. It works collaboratively with six regional Genome Centres, each of which is independently incorporated, in pursuit of agreed-to objectives in genomics research. This approach enables national breadth and regional depth, ensuring collective, pan-Canadian action in determining priorities and delivering programs.



GENOME CENTRES PLAY A SIGNIFICANT ROLE. THEY:

- work with Genome Canada to inform and advise strategy,
- foster regional expertise in genomics research,
- develop partnerships to strengthen regional leadership and competitiveness,
- facilitate researcher access to the technology platforms,
- create unique and innovative public outreach programs, and
- secure co-funding for projects from both domestic and international investors.

The Genome Centres pursue their own strategic objectives informed by regional strengths and priorities. Genome Canada works across the Centres to integrate these regional strengths and priorities into a national approach that aligns with the objectives of the federal government. All of the Genome Centres receive funding from other sources, primarily provincial governments, to further support the priorities of their regions.

The operational costs to fulfil the Centres' mandates are supported by many sources of funding, including Genome Canada. In 2018-19, Genome Canada provided \$880,000 each to Génome Québec, Ontario Genomics and Genome British Columbia, and \$734,800 each to Genome Atlantic, Genome Prairie and Genome Alberta. As recipients of Genome Canada funding, the Genome Centres are subject to regular external assessments.

Governance

Genome Canada is governed by a Board of Directors (“the Board”) comprising no less than nine, but not more than 16, directors. The directors are recruited from the academic, private and public sectors and offer a range of expertise, including genomics research, genomics in society, bioinformatics, academia, the government sector, business, commercialization and communications. New directors are appointed for two-year terms that are renewable. The presidents of each of the following organizations – the Canada Foundation for Innovation, Canadian Institutes of Health Research, National Research Council Canada, Natural Sciences and Engineering Research Council of Canada, and Social Sciences and Humanities Research Council of Canada – are non-voting, *ex officio* advisers to the Board.

The Board has stewardship over the business and affairs of Genome Canada. Its fiduciary responsibilities include strategic leadership, succession planning, risk mitigation, performance and evaluation, and financial oversight.

SEVERAL PERMANENT COMMITTEES ASSIST THE BOARD IN FULFILLING ITS DUTIES:

- an Executive Committee,
- an Audit and Investment Committee,
- a Governance, Election and Compensation Committee,
- a Communications and Outreach Committee, and
- a Programs Committee.

The Board has in place the Science and Industry Advisory Committee (SIAC) that provides advice to the Board on approaches and directions that contribute to the achievement of Genome Canada’s strategic plan. This committee consists of individuals from Canada and abroad who are internationally recognized in the science and industry sectors and in fields relevant to genomics in society.

NUMBER OF MEETINGS HELD BY THE BOARD AND ITS COMMITTEES IN 2018-19

Board of Directors.....	4
Audit and Investment Committee.....	4
Governance, Election and Compensation Committee	4
Communications and Outreach Committee.....	4
Programs Committee	4
Science and Industry Advisory Committee.....	5

Board directors, ex officio advisors, and science and industry committee members in 2018-19

BOARD OF DIRECTORS

Moura Quayle (chair)

Director *pro tem*, UBC School of Public Policy and Global Affairs
Professor, Sauder School of Business
University of British Columbia
Vancouver, British Columbia

Jim Farrell (vice-chair)

Forest Sector Consultant
Ottawa, Ontario

Fiona Brinkman

Professor of Bioinformatics and Genomics, Department of Molecular Biology and Biochemistry Associate Professor at School of Computing Science and at Faculty of Health Sciences
Simon Fraser University
Burnaby, British Columbia

Eric Cook

Executive Director and CEO
Research and Productivity Council
Fredericton, New Brunswick

Elizabeth Douville

General Partner
AmorChem Financial Inc.
Montreal, Quebec

Janice Y. Lederman

Partner, Thompson Dorfman Sweatman LLP (retired)
President, Innovate Manitoba Inc.
Winnipeg, Manitoba

Marc LePage

President and CEO
Genome Canada
Ottawa, Ontario

Kim McConnell

Founder and former CEO,
Adfarm
Calgary, Alberta

Kathryn Phillips

Professor of Health Services Research and Health Economics,
University of California,
San Francisco
San Francisco, California,
U.S.A

Ian Rae

CEO, CloudOps
Montreal, Quebec

Edward Rubin

Chief Science Officer,
Metabiota
San Francisco, California,
U.S.A.

Jacques Simoneau

President and CEO
Gestion Univalor
Montreal, Quebec

Janet Wightman

Managing Director
Kincannon & Reed
Regina, Saskatchewan

Barbara Wold

Bren Professor of Molecular Biology
California Institute of Technology
Pasadena, California, U.S.A

EX OFFICIO ADVISORS

Ted Hewitt

President
Social Sciences and Humanities Research Council of Canada
Ottawa, Ontario

Michael Strong

President
Canadian Institutes of Health Research
Ottawa, Ontario

Roseann O’Reilly Runte

President and CEO
Canada Foundation for Innovation
Ottawa, Ontario

Digvir S. Jayas

Interim
President
Natural Sciences and Engineering Research Council of Canada
Ottawa, Ontario

Iain Stewart

President
National Research Council
Canada
Ottawa, Ontario

**SCIENCE AND INDUSTRY
ADVISORY COMMITTEE**

Doane Chilcoat (chair)

Director, Applied Technology
Systems
DuPont Pioneer
Johnston, Iowa, U.S.A.

Anne-Christine Bonfils

Research Program Manager,
Vice-President's Office – Life
Sciences National Research
Council of Canada
Ottawa, Ontario

Ian Gillespie

Pro Vice-Chancellor, Research
and Enterprise
University of Leicester
Leicester, England

Tina Hambuch

Medical Director, Pediatric
Genetics
Invitae
San Diego, California, U.S.A.

Joan Lunney

Supervisory Research
Scientist
Beltsville Agricultural
Research Center
Beltsville, Maryland, U.S.A.

John MacKay

Wood Professor of Forest
Science, Department of Plant
Sciences
University of Oxford
Oxford, England

Elaine R. Mardis

Professor of Pediatrics, Ohio
State University College of
Medicine
Co-Director, Institute for
Genomic Medicine, Research
Institute, Nationwide Children's
Hospital
Columbus, Ohio, U.S.A.

Dan Roden

Professor of Medicine,
Pharmacology and Biomedical
Informatics
Vanderbilt University
Nashville, Tennessee, U.S.A.

Cami Ryan

Social Sciences Lead
Monsanto Company
St. Louis, Missouri, U.S.A.

Julie Segre

Senior investigator, National
Human Genome Research
Institute, NIH
Chief, Translational and
Functional Genomics Branch
Head, Microbial Genomics
Section
Bethesda, Maryland, U.S.A.

Wyeth Wasserman

Executive Director, BC
Children's Hospital Research
Institute
Associate Dean for Research,
Faculty of Medicine
Senior Scientist, Centre for
Molecular Medicine and
Therapeutics
Professor, Department of
Medical Genetics
University of British Columbia
Vancouver, British Columbia

Susan M. Wood-Bohm

President and CEO
Wood-Bohm and Associates
Douro-Dummer, Ontario

**MANAGEMENT TEAM
2018-19**

Marc LePage

President and CEO

Cindy Bell

Executive Vice-President,
Corporate Development

Rob Annan

Vice-President, Public Affairs
and Communications

Paul St George

Vice-President, Corporate
Services and Chief Financial
Officer

Karl Tibelius

Vice-President, Genomics
Programs

Financial Management

Genome Canada has invested \$3.6 billion in genomics research since its creation in 2000. The federal government provided \$1.5 billion, including investment income from this funding. The remaining \$2.1 billion came from national and international partners, including provincial governments, and private and public sector partners. Genome Canada's investments support large-scale science, access to leading-edge technology, translation, and the operations of Genome Canada and the six regional Genome Centres.

All research projects, with few exceptions, require co-funding from other parties, including provincial governments, universities, the private sector, and other national and international organizations. Genome Canada's funding ratio for co-funding was 1:1 prior to 2012. However, it has since increased to approximately 1:1.6.

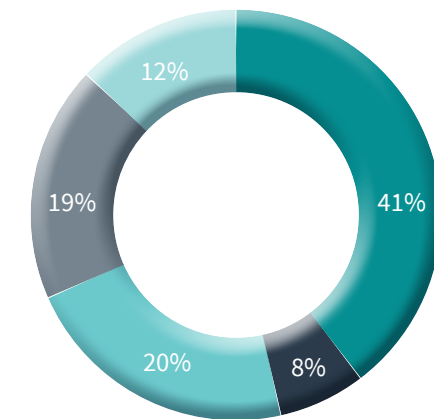
Genome Canada receives funding each year from the federal government based on the annual requirements of research projects. This funding goes to the six Genome Centres, which direct the funds to the individual projects located in their regions. In addition, the projects, administered at institutions, receive funding directly from the required co-funders. The Centres and project leaders must report co-funding quarterly to Genome Canada.

The total annual financial investment in projects is shown in the graph below. Genome Canada and the Centres monitor total project investment. Genome Canada project leaders managed \$182.3 million in funding in 2018-19, comprised of \$62 million from Genome Canada and \$120.3 million from co-funding.

Genome Canada's operating costs were \$6.1 million in 2018-19. Operations include activities relating to genomics programs, strategy, fundraising, communications, governance, performance and evaluation, genomics in society and administration.

Genome Canada's operating costs include the following statement of remuneration. The Board and committee members do not receive remuneration for their services; however, Genome Canada pays the expenses incurred by directors in the performance of their duties. For staff of Genome Canada, there is a compensation policy that includes job classifications and related salary ranges. Genome Canada employees are eligible for performance awards from 10 to 25 per cent.

Investment by Genome Canada and Partners from 2000-19



■ Genome Canada 41% ■ Provincial 20%
■ Industry 12% ■ Federal 8%
■ NPO/Other 19%

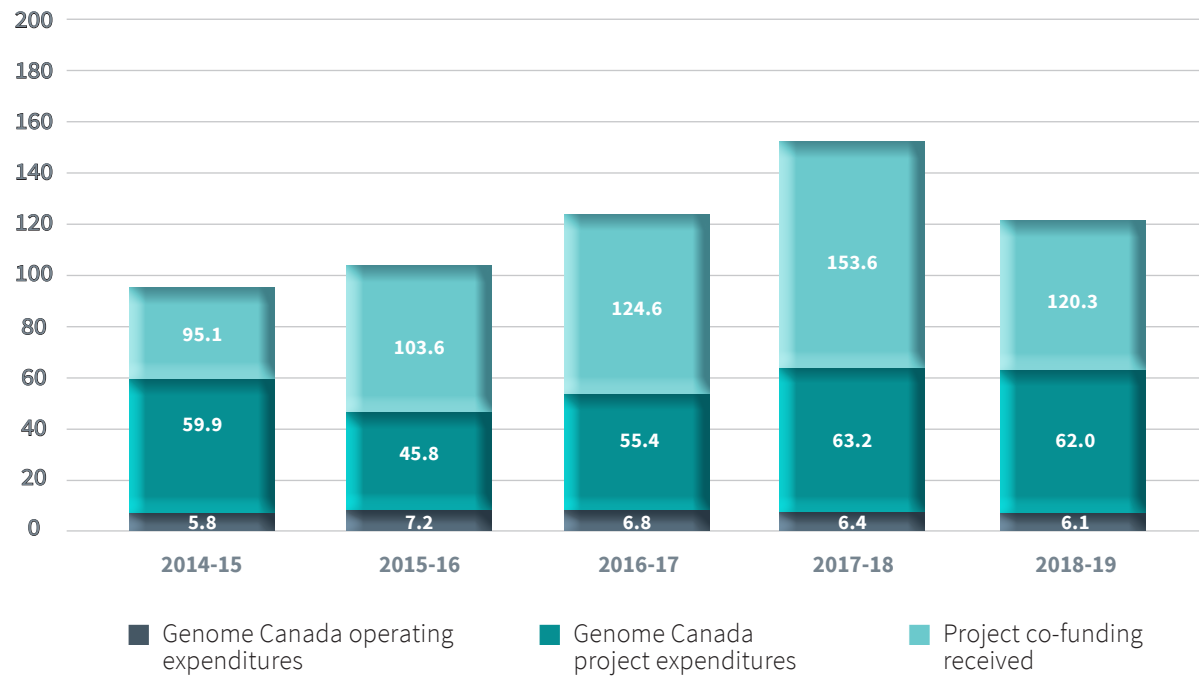
Total Genome Canada funding = \$1.5 billion
Total co-funding = \$2.2 billion
Total investment = \$3.7 billion

For positions that exceeded \$100,000 in the year ended March 31, 2019, the following are the annual salary ranges:

- President and CEO \$275,000 to \$340,000
- Vice-Presidents \$138,786 to \$208,180
- Directors (Band 4) \$107,850 to \$161,775
- Directors (Band 3) \$83,809 to \$121,713

As of March 31, 2019, Genome Canada has \$31.0 million in investments, at market value. These investments are administered in accordance with the Board's approved investment policy and in accordance with the terms and conditions of the contribution agreement with the federal government. The investment policy remained unchanged this past fiscal year.

Annual Activity
(in millions of dollars)



AUDITOR'S REPORT

Financial Statements of
GENOME CANADA
Year ended March 31, 2019

ACKNOWLEDGEMENT

We wish to thank the Government of Canada for its leadership in genomics and continued support of Genome Canada.



GENOME CANADA

Index to Financial Statements

Year ended March 31, 2019

	Page
Independent Auditors' Report	1 - 3
Statement of Financial Position	4
Statement of Operations and Changes in Net Assets	5
Statement of Cash Flows	6
Notes to Financial Statements	7



KPMG LLP
150 Elgin Street, Suite 1800
Ottawa ON K2P 2P8
Canada
Telephone 613-212-5764
Fax 613-212-2896

INDEPENDENT AUDITORS' REPORT

To the Directors of Genome Canada

Opinion

We have audited the financial statements of Genome Canada (the "Entity"), which comprise:

- the statements of financial position as at March 31, 2019
- the statements of operations and changes in net assets for the year then ended
- the statements of cash flows for the year then ended
- and notes to the financial statements, including a summary of significant accounting policies

(Hereinafter referred to as the "financial statements").

In our opinion, the accompanying financial statements present fairly, in all material respects, the financial position of the Entity as at March 31, 2019, and its results of operations and its cash flows for the year then ended in accordance with Canadian accounting standards for not-for-profit organizations.

Basis for Opinion

We conducted our audit in accordance with Canadian generally accepted auditing standards. Our responsibilities under those standards are further described in the "**Auditors' Responsibilities for the Audit of the Financial Statements**" section of our auditors' report.

We are independent of the Entity in accordance with the ethical requirements that are relevant to our audit of the financial statements in Canada and we have fulfilled our other responsibilities in accordance with these requirements.

We believe that the audit evidence we have obtained is sufficient and appropriate to provide a basis for our opinion.

Other Information

Management is responsible for the other information. Other information comprises:

- the information, other than the financial statements and the auditors' report thereon, included in Annual Report document.

Our opinion on the financial statements does not cover the other information and we do not and will not express any form of assurance conclusion thereon.



In connection with our audit of the financial statements, our responsibility is to read the other information identified above and, in doing so, consider whether the other information is materially inconsistent with the financial statements or our knowledge obtained in the audit and remain alert for indications that the other information appears to be materially misstated.

We obtained the information, other than the financial statements and the auditors' report thereon, included in the Annual Report document as at the date of this auditors' report. If, based on the work we have performed on this other information, we conclude that there is a material misstatement of this other information, we are required to report that fact in the auditors' report.

We have nothing to report in this regard.

Other Matter – Comparative Information

The financial statements for the year ended March 31, 2018 were audited by another auditor who expressed an unmodified opinion on those financial statements on June 21, 2018.

Responsibilities of Management and Those Charged with Governance for the Financial Statements

Management is responsible for the preparation and fair presentation of the financial statements in accordance with Canadian accounting standards for not-for-profit organizations, and for such internal control as management determines is necessary to enable the preparation of financial statements that are free from material misstatement, whether due to fraud or error.

In preparing the financial statements, management is responsible for assessing the Entity's ability to continue as a going concern, disclosing as applicable, matters related to going concern and using the going concern basis of accounting unless management either intends to liquidate the Entity or to cease operations, or has no realistic alternative but to do so.

Those charged with governance are responsible for overseeing the Entity's financial reporting process.

Auditors' Responsibilities for the Audit of the Financial Statements

Our objectives are to obtain reasonable assurance about whether the financial statements as a whole are free from material misstatement, whether due to fraud or error, and to issue an auditors' report that includes our opinion.

Reasonable assurance is a high level of assurance, but is not a guarantee that an audit conducted in accordance with Canadian generally accepted auditing standards will always detect a material misstatement when it exists.

Misstatements can arise from fraud or error and are considered material if, individually or in the aggregate, they could reasonably be expected to influence the economic decisions of users taken on the basis of the financial statements.

As part of an audit in accordance with Canadian generally accepted auditing standards, we exercise professional judgment and maintain professional skepticism throughout the audit.



We also:

- Identify and assess the risks of material misstatement of the financial statements, whether due to fraud or error, design and perform audit procedures responsive to those risks, and obtain audit evidence that is sufficient and appropriate to provide a basis for our opinion.

The risk of not detecting a material misstatement resulting from fraud is higher than for one resulting from error, as fraud may involve collusion, forgery, intentional omissions, misrepresentations, or the override of internal control.

- Obtain an understanding of internal control relevant to the audit in order to design audit procedures that are appropriate in the circumstances, but not for the purpose of expressing an opinion on the effectiveness of the Entity's internal control.
- Evaluate the appropriateness of accounting policies used and the reasonableness of accounting estimates and related disclosures made by management.
- Conclude on the appropriateness of management's use of the going concern basis of accounting and, based on the audit evidence obtained, whether a material uncertainty exists related to events or conditions that may cast significant doubt on the Entity's ability to continue as a going concern. If we conclude that a material uncertainty exists, we are required to draw attention in our auditors' report to the related disclosures in the financial statements or, if such disclosures are inadequate, to modify our opinion. Our conclusions are based on the audit evidence obtained up to the date of our auditors' report. However, future events or conditions may cause the Entity to cease to continue as a going concern.
- Evaluate the overall presentation, structure and content of the financial statements, including the disclosures, and whether the financial statements represent the underlying transactions and events in a manner that achieves fair presentation.
- Communicate with those charged with governance regarding, among other matters, the planned scope and timing of the audit and significant audit findings, including any significant deficiencies in internal control that we identify during our audit.

Chartered Professional Accountants, Licensed Public Accountants

Ottawa, Canada

June 20, 2019

GENOME CANADA

Statement of Financial Position

March 31, 2019, with comparative information for 2018
(in thousands of dollars)

	2019	2018
Assets		
Current assets:		
Cash	\$ 10,672	\$ 1,234
Short-term investments (note 3)	30,996	38,275
Interest receivable	12	82
Other receivables	76	218
Prepaid expenses	244	170
	<u>42,000</u>	<u>39,979</u>
Capital assets (note 4)	39	46
	<u>\$ 42,039</u>	<u>\$ 40,025</u>

Liabilities and Net Assets

Current liabilities:		
Accounts payable and accrued liabilities (note 5)	\$ 782	\$ 824
Deferred contributions - research projects (note 6(a))	40,091	39,155
	<u>40,873</u>	<u>39,979</u>
Deferred lease inducements (note 7)	177	-
Deferred contributions (note 6)		
Deferred contributions - internally restricted	950	-
Deferred contributions related to capital assets	39	46
	<u>989</u>	<u>46</u>
Commitments (note 10)		
Contingencies (note 11)		
	<u>\$ 42,039</u>	<u>\$ 40,025</u>

See accompanying notes to financial statements.

On behalf of the Board:

Director

Director

GENOME CANADA

Statement of Operations and Changes in Net Assets

Year ended March 31, 2019, with comparative information for 2018
(in thousands of dollars)

	2019	2018
Revenue:		
Amortization of deferred contributions – research projects	\$ 68,054	\$ 69,558
Amortization of deferred contributions related to capital assets (note 6)	16	54
	<u>68,070</u>	<u>69,612</u>
Expenses:		
Projects and Genome Centres	61,977	63,247
Program management	1,732	2,184
Strategy, development and external relations	1,928	1,547
Corporate services	2,417	2,580
Amortization of capital assets	16	54
	<u>68,070</u>	<u>69,612</u>
Excess of revenue over expenses, being net assets, end of year	<u>\$ -</u>	<u>\$ -</u>

See accompanying notes to financial statements.

GENOME CANADA

Statement of Cash Flows

Year ended March 31, 2019, with comparative information for 2018
(in thousands of dollars)

	2019	2018
Cash provided by (used in):		
Operating activities:		
Excess of revenue over expenses	\$ —	\$ —
Items not affecting cash:		
Amortization of capital assets	16	54
Amortization of deferred lease inducement	(2)	—
Amortization of deferred contributions – research projects	(68,054)	(69,558)
Amortization of deferred contributions related to capital assets	(16)	(54)
Excluded from the increase in deferred contributions (note 9)	86	(135)
	(67,970)	(69,693)
Grants received from Government of Canada (note 6)	68,700	59,100
Reimbursement of disbursements to approved projects	491	—
Deferred lease inducement	179	—
Deferred contributions related to capital assets	9	—
Changes in non-cash operating working capital items:		
Decrease (increase) in other receivables	142	(125)
Increase in prepaid expenses	(74)	(15)
Increase (decrease) in accounts payable and accrued liabilities	(42)	116
	69,405	59,076
Investing activities:		
Decrease in short-term investments	7,279	10,184
Interest received on investments	781	746
Portfolio investment management	(48)	(65)
Purchase of capital assets	(9)	—
	8,003	10,865
Net change in cash	9,438	248
Cash, beginning of year	1,234	986
Cash, end of year	\$ 10,672	\$ 1,234

See accompanying notes to financial statements.

GENOME CANADA

Notes to Financial Statements

Year ended March 31, 2019
(in thousands of dollars)

1. Description of the organization:

Genome Canada (the "Corporation") was incorporated on February 8, 2000, under the Canada Corporations Act and continued on December 11, 2012. The Corporation is a not-for-profit organization and has the following objectives:

- (a) The development and establishment of a co-ordinated strategy for genomics research to enable Canada to become a world leader in areas such as health, agriculture, environment, forestry, fisheries, mining and energy;
- (b) The provision of leading-edge technology to researchers in all genomics-related fields through regional Genome Centres across Canada, of which there are currently six, one each in British Columbia, Alberta, the Prairies, Ontario, Quebec and the Atlantic;
- (c) The support of large-scale projects of strategic importance to Canada by bringing together industry, government, universities, research hospitals and the public;
- (d) The assumption of leadership in the area of ethical, environmental, economic, legal, social and other issues related to genomics research, and the communication of the relative risks, rewards and successes of genomics to the Canadian public; and
- (e) The encouragement of investment by others in the field of genomics research.

2. Significant accounting policies:

The financial statements have been prepared by management in accordance with Canadian accounting standards for not-for-profit organizations and include the following significant accounting policies:

(a) Revenue recognition:

The Corporation follows the deferral method of accounting for contribution for not-for-profit organizations received from the Government of Canada.

Externally restricted contributions and related investment income are recognized as revenue in the year in which the underlying expenses are incurred. A receivable is recognized if the amount to be received can be reasonably estimated and collection is reasonably assured.

Externally restricted contributions for the purchase of capital assets are deferred and amortized to revenue on a declining balance basis at a rate corresponding to the amortization rate for the related capital assets.

(b) Investments:

Investments are recorded at fair value. Fair value is determined at quoted market prices. Sales and purchases of investments are recorded at the settlement date. Short-term investments can be easily converted to cash during the period. Transaction costs related to the acquisition of investments are expensed.

GENOME CANADA

Notes to Financial Statements (continued)

Year ended March 31, 2019
(in thousands of dollars)

2. Significant accounting policies (continued):

(c) Capital assets:

Capital assets are stated at their net book value. Amortization is provided for using the declining balance method at the following annual rates or term:

Asset	Rate
Furniture, fixtures and office equipment	20%
Leasehold improvements	Term of the lease

(d) Financial instruments:

The Corporation records interest receivable, other receivables and accounts payable and accrued liabilities at amortized cost using the effective interest method of amortization.

(e) Use of estimates:

The preparation of financial statements in conformity with Canadian accounting standards for not-for-profit organizations requires the use of estimates and assumptions that affect the reported amounts of assets and liabilities, disclosures of contingent assets and liabilities at the date of the financial statements and the reported amounts of revenues and expenses during the reporting periods. Accordingly, actual results could differ from these estimates. The most significant estimates used in the preparation of the financial statements include the fair value of investments, the amount of certain accrued liabilities and the estimated useful lives of capital assets. These estimates are reviewed annually and as adjustments become necessary, they are recorded in the financial statements in the year in which they become known.

(f) Lease inducements

Lease inducements, consisting of free rent and improvement allowances granted to the Corporation for the leased offices, are amortized on a straight-line basis over the term of the lease or over the useful life of the purchased asset.

GENOME CANADA

Notes to Financial Statements (continued)

Year ended March 31, 2019
(in thousands of dollars)

3. Short-term investments:

	2019		2018	
	Cost	Fair market value	Cost	Fair market value
Government of Canada Treasury bills	\$ 1,655	\$ 1,656	\$ 3,606	\$ 3,610
Government of Canada Bonds	–	–	2,484	2,484
Bank deposits/Bankers' Acceptance	6,730	6,736	5,262	5,270
Commercial paper	5,809	5,824	6,905	6,916
Provincial/Municipal Short term bills and notes	6,654	6,673	8,332	8,347
Federal government bonds	800	800	1,510	1,502
Provincial government bonds	6,547	6,548	2,597	2,580
Corporate bonds	2,760	2,759	7,614	7,566
	\$ 30,955	\$ 30,996	\$ 38,310	\$ 38,275

The interest rates at the end of the year range from 0.000% to 6.800% (2018 - 0.000% to 6.020%) and mature at varying dates in 2019 (2018 - varying dates in 2018 and 2019).

4. Capital assets:

	2019		2018	
	Cost	Accumulated amortization	Net book value	Net book value
Furniture, fixtures and office equipment	\$ 442	\$ 403	\$ 39	\$ 38
Leasehold improvements	–	–	–	8
	\$ 442	\$ 403	\$ 39	\$ 46

Cost and accumulated amortization at March 31, 2018, amounted to \$376 and \$330, respectively.

5. Accounts payable and accrued liabilities:

Included in accounts payable and accrued liabilities are \$2 (2018 - \$Nil) for goods and services tax/harmonized sales tax and payroll-relates taxes due to government entities.

GENOME CANADA

Notes to Financial Statements (continued)

Year ended March 31, 2019
(in thousands of dollars)

6. Deferred contributions:

The Corporation receives contributions from the Government of Canada to be held, invested, administered and disbursed in accordance with the related funding agreement between the Corporation and the Government of Canada.

(a) Deferred contributions - research projects:

The Corporation operates under two active Funding Agreements with the Government of Canada. As at March 31, 2018, Innovation, Science and Economic Development Canada had committed \$402,200 in grants to the Corporation under these agreements, of which \$237,400 has been received as at March 31, 2019. The terms and conditions of these agreements call for remaining grants to be paid to the Corporation annually, subject to the appropriation by the Parliament, based on the estimated cash requirements for the year. During the year ended March 31, 2019, the Corporation received \$20,300 under the agreement dated March 10, 2014, and \$48,400 under the agreement dated May 19, 2017.

The changes in the deferred contributions balance for the year are as follows:

	2019	2018
Balance, beginning of year	\$ 39,155	\$ 49,110
Add: grants received	68,700	59,100
Add: reimbursement of disbursements to approved projects	491	—
Add: investment income	758	503
Less: amounts amortized to revenue	(68,054)	(69,558)
Less: amounts invested in capital assets	(9)	—
Less: amounts internally allocated to wind-down costs	(950)	—
Balance, end of year	\$ 40,091	\$ 39,155

Expenses of future years:

Deferred contributions related to expenses of future years represent unspent externally restricted funding received to date, together with investment revenue earned, for the purpose of providing funds to eligible recipients and paying for operating and capital expenditures in future years.

GENOME CANADA

Notes to Financial Statements (continued)

Year ended March 31, 2019
(in thousands of dollars)

6. Deferred contributions (continued):

(b) Deferred contributions related to capital assets:

Deferred contributions related to capital assets represent restricted contributions with which capital assets were originally purchased.

The changes in the deferred contributions balance for the year are as follows:

	2019	2018
Balance, beginning of year	\$ 46	\$ 100
Add: acquisition of capital assets	9	—
Less: amounts amortized to revenue	(16)	(54)
Balance, end of year	\$ 39	\$ 46

(c) Deferred contributions - internally restricted:

On March 21, 2019, the Board of Directors approved an internal restricted reserve from previously received deferred contributions of \$950. The amount will be held to cover costs of a potential wind-down of the organization. Interest and investment income earned from these restricted amounts is recognized as income during the year it is earned, and redistributed to the deferred contributions for future research project distribution.

7. Lease inducements:

The lease inducements include the following amounts:

	2019	2018
Leasehold improvement allowances	\$ 136	\$ —
Free rent	41	—
Total lease inducements	\$ 177	\$ —

During the year, leasehold improvement allowances and free rent of \$179 (2018: \$Nil) were provided. The amortization of leasehold improvement allowances and free rent are \$Nil and \$2, respectively (2018: \$Nil and \$Nil, respectively).

GENOME CANADA

Notes to Financial Statements (continued)

Year ended March 31, 2019
(in thousands of dollars)

8. Employee pension plan:

The Corporation maintains, for the benefit of almost all of its employees, a defined contribution pension plan. The cost of the plan is recorded in the statement of operations and changes in net assets as it is incurred. The charge for the year totals \$201 (2018 - \$195).

9. Supplemental cash flow information:

	2019	2018
Gain (loss) on disposal of investments	\$ 17	\$ (184)
Amount transferred to capital assets	(9)	—
Fair value adjustment	78	49
	<u>\$ 86</u>	<u>\$ (135)</u>

10. Commitments:

Committed funding:

The Corporation is committed to finance approved research projects, science and technology platforms and Genome Centre operations in accordance with established agreements. As at March 31, 2019, the payments committed are approximately \$64,704 in 2020 and \$42,059 for other future years.

Operating leases:

The Corporation leases its premises and equipment under long-term operating leases, which expire at various dates between 2020 and 2028. The minimum aggregate lease payments are approximately as follows:

2020	\$ 100
2021	99
2022	96
2023	100
2024 and thereafter	558
	<u>\$ 953</u>

GENOME CANADA

Notes to Financial Statements (continued)

Year ended March 31, 2019
(in thousands of dollars)

11. Contingencies:

In the normal course of business, the Corporation has entered into a lease agreement for premises. It is common in such commercial lease transactions for the Corporation as the lessee to agree to indemnify the lessor for liabilities that may arise from the use of the leased assets. The maximum amount potentially payable under the foregoing indemnities cannot be reasonably estimated. The Corporation has liability insurance that relates to the indemnifications described above.

12. Financial risk management:

The Corporation is subject to the following risks due to its financial instruments:

(a) Foreign currency risk:

Foreign currency risk is the risk that the fair value or future cash flows of a financial instrument will fluctuate because of changes in foreign exchange rates. The Corporation holds \$13 in foreign currency.

(b) Liquidity risk:

Liquidity risk is the risk that the Corporation will be unable to fulfill its obligations associated with financial liabilities or to meet cash requirements on a timely basis or a reasonable cost. The Corporation manages its liquidity risk by monitoring its operating requirements. The Corporation prepares budgets and cash forecasts to ensure it has sufficient funds to fulfill its obligations.

(c) Credit risk:

Credit risk refers to the risk that a counterparty may default on its contractual obligations resulting in a financial loss. The Corporation is exposed to credit risks with respect to its interest-bearing investments. The Corporation invests in government bonds to reduce the credit risk to an acceptable level.

(d) Interest rate risk:

Interest rate risk is the risk that the fair value or future cash flows of a financial instrument will fluctuate because of changes in interest rates. The Corporation is exposed to interest rate risk with respect to its interest-bearing investments as disclosed in note 3 to the financial statements.

GENOME CANADA

Notes to Financial Statements (continued)

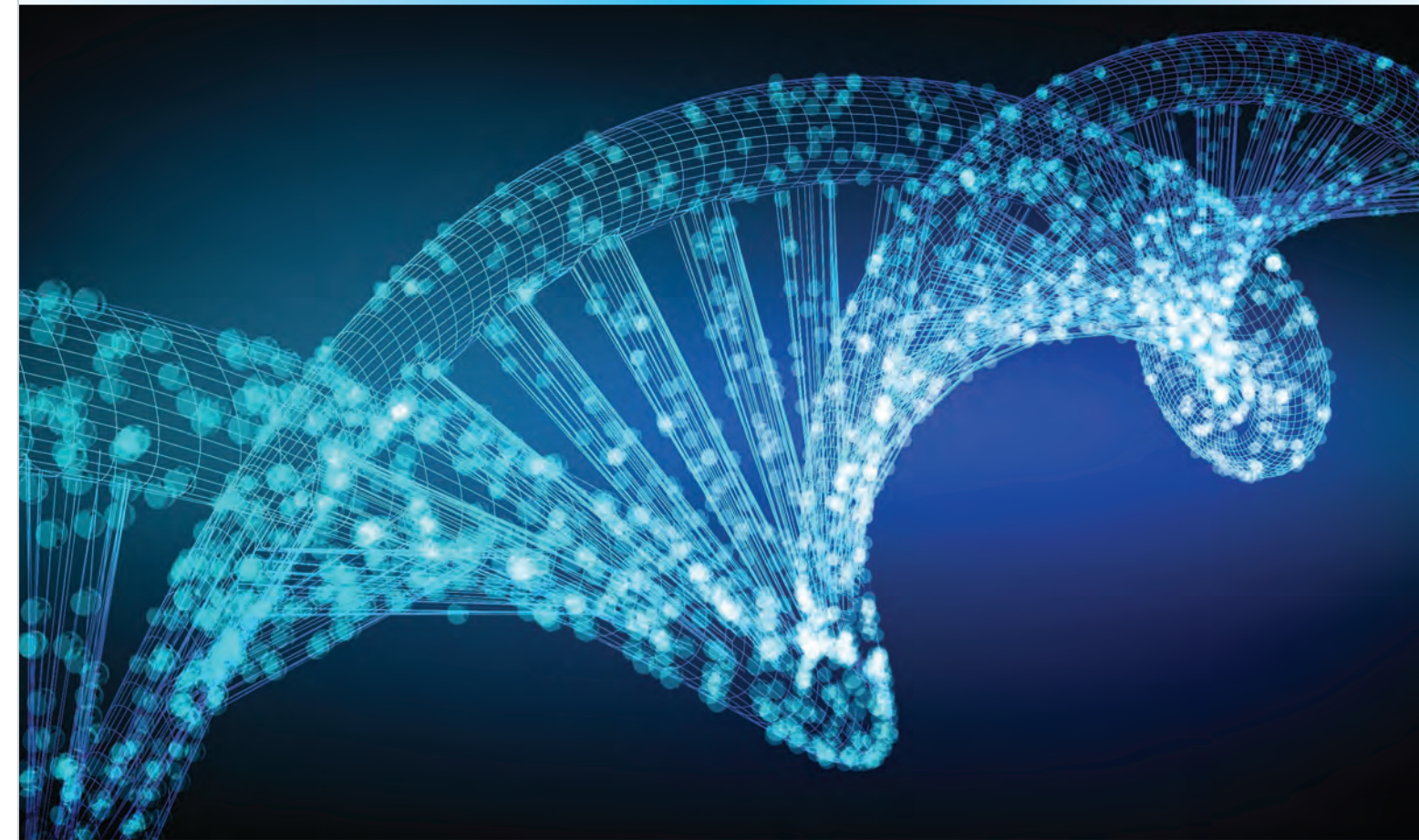
Year ended March 31, 2019
(in thousands of dollars)

12. Financial risk management (continued):

(e) Other price risk:

Other price risk is the risk that the fair value or future cash flows of a financial instrument will fluctuate because of changes in market prices. The fair value of investments is disclosed in note 3 to the financial statements.

The Corporation is not subject to significant risks from its financial instruments. There has been no significant change in the risk exposures of the Corporation compared to the fiscal year 2018.





GenomeCanada

150 Metcalfe Street, Suite 2100
Ottawa, ON K2P 1P1

www.genomecanada.ca