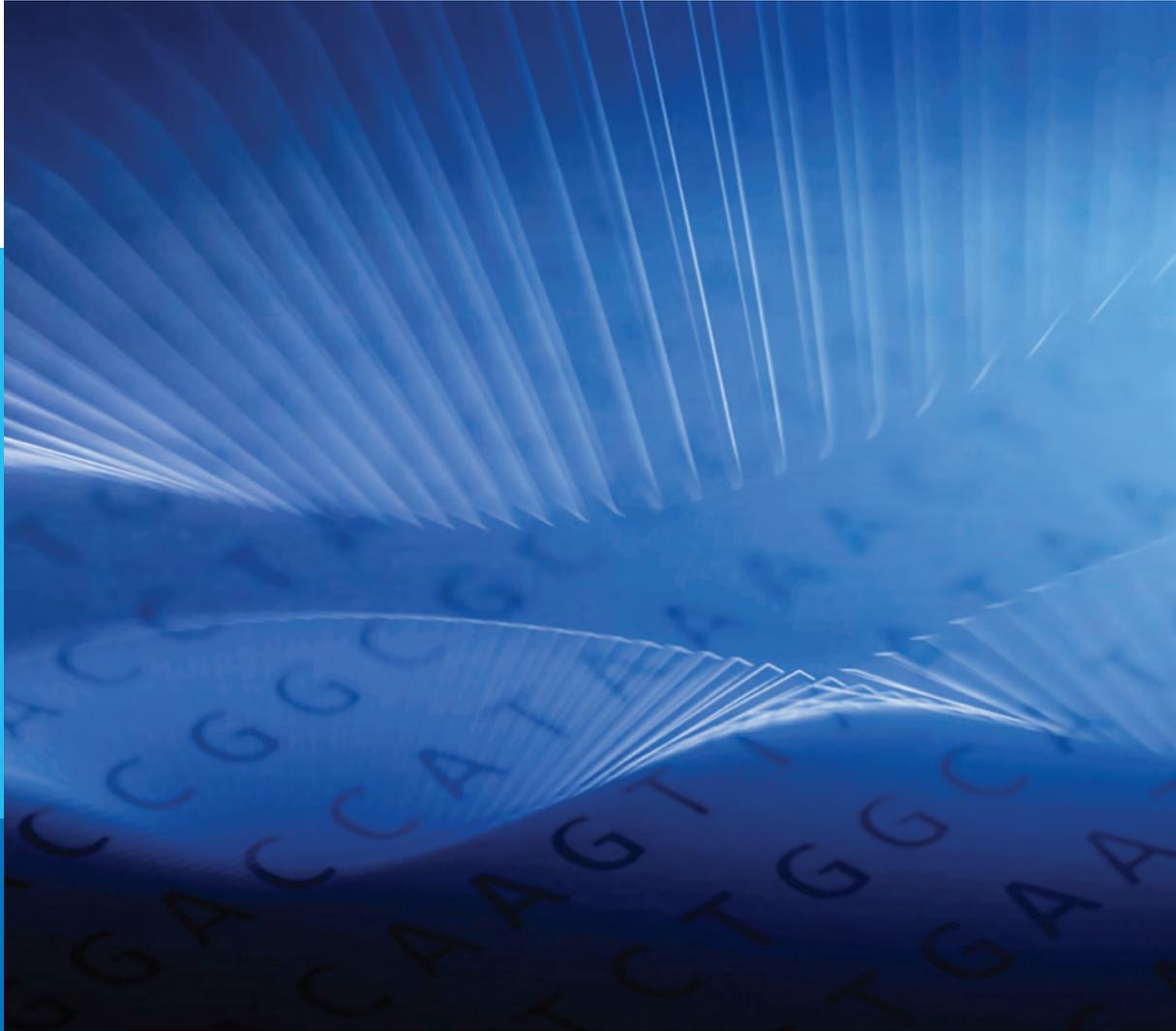




GenomeCanada



2017

2018

# Corporate Plan

GLOBAL CHALLENGES ♦ GENOMIC SOLUTIONS

Published by Genome Canada

Extracts 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 prior written permission from Genome Canada.

© Genome Canada 2017



**Genome**Canada

# Table of Contents

|     |  |    |
|-----|--|----|
| 1.0 | About Genome Canada .....                                      | 3  |
|     | Organizational context .....                                   | 3  |
|     | Genome Canada's range of programs .....                        | 4  |
|     | Commitment to accountability .....                             | 5  |
|     | Governance .....   | 6  |
|     | Genome Canada's strategic directions .....                     | 7  |
| 2.0 | Results 2016-17 .....  | 8  |
|     | Short- and medium-term outputs and outcomes from 2016-17 ..... | 8  |
|     | Successes and remaining challenges from 2016-17 .....          | 12 |
| 3.0 | Planned Activities 2017-18 .....                               | 13 |
|     | Genome Canada's funds and initiatives .....                    | 13 |
|     | Delivering ongoing programs .....                              | 13 |
|     | Project and program planning 2017-18 .....                     | 18 |
| 4.0 | Finance Management .....                                       | 23 |
|     | Investment and management of funds .....                       | 23 |
|     | Source and use of funds .....                                  | 23 |
|     | Cash management .....  | 24 |
|     | Receipts and disbursements .....                               | 24 |
| 5.0 | Risk Assessment and Mitigation Measures .....                  | 26 |
|     | Risk management .....  | 26 |
|     | Annual audit .....   | 26 |
|     | Recipient audit .....  | 26 |
|     | Compliance audit .....   | 27 |
|     | Evaluation .....   | 27 |

# 1.0 About Genome Canada

## Organizational context

Genome Canada is a not-for-profit organization that acts as a catalyst for developing and applying genomics and genomics-based technologies to create economic and social benefits for Canadians. Genome Canada connects ideas and people across public and private sectors to find new uses for genomics, invests in large-scale science and technology to fuel innovation, and translates discoveries into solutions across key sectors of national importance.

Genome Canada catalyzes multidisciplinary research and innovation across sectors where genomics can contribute solutions. This provides clear opportunities for Canada to play a leading international role in emerging global issues such as antimicrobial resistance, climate change, increasing energy demand, population growth and an aging population.

Since our inception in 2000, Genome Canada together with six regional Genome Centres have been at the heart of Canada's genomics enterprise – a complex yet collaborative network of individuals and organizations consisting of those who fund research, those who conduct it, those equipped to translate research into applications, and those who will implement these applications to the benefit of Canadians.

Backed by federal investments, Genome Canada and the Genome Centres have fuelled the enterprise and set a national agenda for genomics in Canada. We lead Canada's genomics enterprise within a broader science, technology and innovation ecosystem. As the only agency in Canada with a singular focus on genomics – and its applications across multiple sectors of importance to Canada – we play a unique role in this ecosystem.



**Figure 1: Genome Centres across Canada**

Through myriad partnerships and strategic program design, we ensure our alignment with key federal players such as granting councils, science-based departments and federally funded not-for-profit

organizations. We work with such entities to ensure a continuum of funding support across the entire life cycle of a research project – from discovery to application in the marketplace and public sector.

Genome Canada's business model provides national coordination while setting strategic direction that is responsive to regional needs and priorities. Our upfront engagement with users of genomics ensures that the research we support is strategic and purpose-driven, with a greater likelihood of being translated into applications that target opportunities and solve challenges in all sectors of our bioeconomy and across all regions of Canada.

This focus is important because only in Canada will research and development (R&D) be undertaken to address Canadian priorities such as:

- the sustainability and productivity of our farms, forests and fisheries,
- the environmental footprint of our oil and mining industries,
- the viability of our health-care system, and
- the improvement of health and economic opportunities in the Arctic and for Indigenous peoples.

Securing co-funding through partnerships is central to our business model. We bring together diverse partners to co-invest in Canadian genomics research for the benefit of our society. In collaboration with the Genome Centres, we have leveraged \$1.3 billion in federal funding since 2000 for a total investment of \$3.0 billion for genomics research in Canada.

Genomics is a maturing science but we are only beginning to see the enormous potential of this cutting-edge field of inquiry as it starts to unfold. As technological advances accelerate, early demonstrations of impact become clear. Thanks to sustained federal funding and the achievements of researchers supported by Genome Canada, the regional Genome Centres and our partners, Canada is now a powerhouse in genomics. We are poised to build on this success and generate competitive advantages for Canadian sectors globally through genomics.

### **Genome Canada's range of programs**

Genome Canada supports the advancement of genomics in Canada. The knowledge generated through its funding programs supports evidence-based policy-making, strengthens Canada's bioeconomy and improves the quality of life for Canadians. Since its inception in 2000, Genome Canada has evolved its suite of programs to reflect both the rapidly changing state of genomics-based science and the opening up of opportunities across all sectors of the bioeconomy, driven by users of genomics technology in the private and public sectors. Today, our portfolio of programs supports discovery research through to translation and into application.

Large-Scale Applied Research Project (LSARP) competitions fuel the innovation pipeline. Through the LSARP program, Genome Canada supports discovery and applied research. It also encourages investigators to explore the potential uses of their discoveries by engaging with those who can help translate the research into applications that benefit Canadian society and the bioeconomy.

The Genomic Applications Partnership Program (GAPP) is an academic-receptor partnered program whose goal is to increase and accelerate the positive social and economic impact of Canada's genomics R&D capacity. GAPP's objectives are to:

- accelerate the application of Canadian genomics-derived solutions to real-world opportunities and challenges defined by industry and the public sector,
- channel Canada's genomics capacity into sustainable innovations that benefit Canadians,

- enhance the value of Canadian genomics technologies and incentivize investment from industry and other partners, and
- foster mutually beneficial collaboration and knowledge exchange between Canadian academia and technology receptors.

## WE INVEST IN THE ENTIRE SPECTRUM OF INNOVATION



From discovery and applied research through translation into real-world applications driven by user pull, Genome Canada is solving challenges in all key sectors of our bioeconomy

**Figure 2: Genome Canada's suite of programs**

Underpinning our research funding programs are technology programs, designed to provide Canadian scientists with access to leading-edge technologies, including bioinformatics and computational biology tools needed to manage, analyze and interpret the ever-growing amount of data produced through genomics inquiry. Just as technology underpins the genomics scientific endeavour, so does understanding the broad societal implications of genomics research and its applications. Through its programs addressing genomics and its ethical, environmental, economic, legal and social (GE<sup>3</sup>LS) aspects, as well as genomics in society, Genome Canada supports the exploration of issues. These include investigating what advancements in science and technology mean for our society, how public confidence plays into the effective development of genomics applications in Canada, and how public policy can adapt accordingly. The goal is to identify barriers to the uptake of genomics-derived applications in society early in the process.

### Commitment to accountability

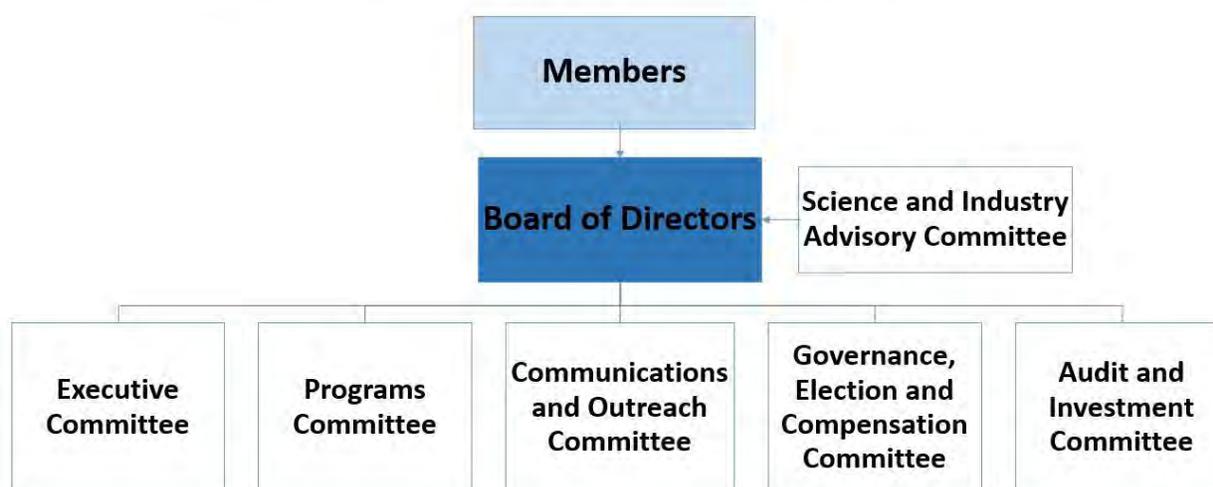
In delivering its mandate, Genome Canada is committed to applying the highest standards of accountability and transparency to its operations, informing Canadians about the exciting opportunities and promise that genomics holds and reporting on results achieved. Mechanisms and instruments such as corporate plans and annual reports, independent performance audit and evaluation studies, peer review and research oversight committee processes, annual attest audits, continuous risk management assessment and effective oversight by the board of directors provide a high level of assurance. Genome Canada rigorously monitors its expenditures in order to manage operations in a fiscally prudent manner.

## Governance

Genome Canada was established in February 2000 under the *Canada Corporations Act* and, in 2012, was issued new Articles of Continuance under the *Canada Not-for-Profit Corporations Act*.

Genome Canada is governed by a board of directors comprising up to 16 individuals drawn from the academic, private and public sectors. These individuals bring unique skills and experiences as well as strong interests and insights to successfully fulfil Genome Canada's strategic plan. Furthermore, the presidents of five federal research funding agencies – the Canada Foundation for Innovation, the Canadian Institutes of Health Research (CIHR), the National Research Council, the Natural Sciences and Engineering Research Council and the Social Sciences and Humanities Research Council – are non-voting, ex officio advisors to the board of directors. While the Genome Centres do not form part of the genomics enterprise governance structure, they are deeply involved at all levels of our work, from strategy to program administration.

### Genome Canada's Governance Structure



**Figure 3: Genome Canada's governance structure**

The board of directors has overall responsibility for the stewardship of Genome Canada's business and affairs. To help with the discharge of these duties, the board has five standing committees:

- an executive committee,
- a programs committee,
- a communications and outreach committee,
- a governance, election and compensation committee, and
- an audit and investment committee.

The science and industry advisory committee is a permanent committee of Genome Canada's board of directors. The committee is tasked with providing advice and recommendations to the board on:

- emerging scientific research opportunities, and challenges and potential areas for investment in genomics, including genomics in society and GE<sup>3</sup>LS research in Canada,
- international trends and developments, and potential national and international collaborations,
- areas of strategic social and economic importance to Canada, and
- the application of genomics research outcomes, including commercialization, knowledge transfer, policy development, and social and economic benefits.

## Genome Canada’s strategic directions

In 2012, Genome Canada launched *Genome Canada Strategic Plan 2012–2017*, a five-year strategic plan. It included two new sectors, mining and energy, that joined five existing sectors of importance: human health, agriculture and agri-food, forestry, fisheries and aquaculture, and the environment. This strategic plan reflected an important added focus for Genome Canada – the growing influence of genomics as a transformative technology that will play a key role in addressing the most pressing challenges facing society in the 21st century.



Figure 4: Genome Canada’s mission

## 2.0 Results 2016-17

Genome Canada has placed more emphasis on innovation by supporting the application of knowledge gained from Canadian genomics research to real-world opportunities and challenges. Doing this grows the Canadian bioeconomy. At the same time, we continue to support the discovery and applied research that fuels the innovation pipeline. Our programs and initiatives are purpose-driven, supporting projects with the greatest potential for social and economic benefits for Canadians. Our approach ensures alignment and complementarity with other key members of Canada's science, technology and innovation ecosystem to mutually reinforce our strategies and objectives and capitalize on synergies that can be derived from working together.

### Short- and medium-term outputs and outcomes from 2016-17

In 2016-17, Genome Canada achieved a broad and substantial range of short- and medium-term outputs and outcomes. They include the following.

- **Continued investment in the 2012 LSARP Competition – Genomics and Personalized Health.** Throughout 2016-17, Genome Canada, in partnership with CIHR, continued to invest in the competition, providing a total of \$158.6 million to 17 projects. These projects aim to demonstrate how genomics can contribute to a more evidence-based approach to health, improve the cost-effectiveness of the health-care system, and ensure that discoveries are translated into patient and population benefits. Areas of focus included tailoring patient treatments and therapies through the application of genomics in fields as diverse as epilepsy, autism, HIV/AIDS, cancer, cardiovascular disease, rare neurological diseases and stroke, among others.
- **Continued investment in the 2014 LSARP Competition – Genomics and Feeding the Future.** Genome Canada has continued to fund the 11 projects announced in 2015 via a \$94.6-million investment. The projects use genomics approaches within the agriculture/agri-food and fisheries/aquaculture sectors to address challenges and opportunities related to global food safety, security and sustainable production. Funding flowed to projects focused on the application of genomics in sustainable fisheries and honeybees, stress and disease resistance of flora and fauna, and innovations in lentil, wheat, methane emissions and disease prevention.
- **Completion of the 2015 LSARP Competition – Natural Resources and the Environment: Sector Challenges – Genomic Solutions, announcement of results and provision of funding.** Genome Canada is investing a total of \$112.2 million in 13 projects. The scope of this competition included genomics research in energy, mining, forestry, water stewardship, wildlife management and conservation, and bioproducts that help conserve natural resources and protect the environment. The projects' outcomes are expected to address challenges and opportunities related to natural resources and the environment. Outcomes have the potential to contribute to the Canadian bioeconomy and well-being of Canadians.
- **Funding of more projects through the ongoing GAPP.** Throughout 2016-17, Genome Canada continued to invest in GAPP. This included funding two new rounds of projects. A total of \$123.1 million is currently invested in 31 receptor-led projects. Through GAPP, we are connecting academic researchers with receptors in industry and the public sector. GAPP was designed to increase collaboration between genomics scientists and users of genomics research to advance projects that address real-world challenges and opportunities, and to stimulate investment from private and public partners in Canadian genomics technologies. In the most recent round, projects ranged from helping protect Atlantic salmon from infections, leading to potentially \$57 million in savings annually, to enhancing the quality and efficiency of pork production, contributing to a \$23.8-billion industry in Canada.

- **Continued partnership with Mitacs through GAPP to provide training opportunities in the private sector.** Mitacs is a non-profit, national research organization that manages and funds research and training programs for undergraduate and graduate students as well as post-doctoral fellows in partnership with universities, industry and government in Canada. A Genome Canada partnership with Mitacs provides placements and funding for graduate students and post-doctoral fellows to work on GAPP projects within industry partners' operations. The partnership prepares Canada's next generation of innovators to advance the field of genomics by allowing candidates to apply their knowledge and skills in a real-world setting. Companies, meanwhile, benefit from the high-quality research expertise. This partnership currently supports 8.7 individuals through Mitacs Accelerate internships in GAPP projects.
- **Funding of the GE<sup>3</sup>LS Network in genomics and personalized health.** As part of the Genomics and Personalized Health 2012 LSARP competition, the GE<sup>3</sup>LS Network was introduced as a way to cross-fertilize and leverage the efforts of genomics research across the 17 projects. Through an investment of up to \$2 million, the network will facilitate the sharing of best practices, prime and improve future research collaboration, accelerate the progress toward application of technologies, and maximize the impact of investments in these projects.
- **Ongoing investment in emerging issues.** Genome Canada is currently funding emerging issues projects that address important and timely needs. These issues include the porcine epidemic diarrhea virus in pork, avian influenza, the Zika virus and the Mount Polley Mine tailings dam breach in British Columbia.
- **2015 E-Rare-3 Joint Transnational Call: Translational Research Projects on Rare Diseases projects announcement.** This funding opportunity funds nine projects. The opportunity was created in collaboration with five Canadian partners – CIHR, Fonds de recherche du Québec – Santé, the Ataxia Charlevoix-Saguenay Foundation, Cystic Fibrosis Canada and Muscular Dystrophy Canada – and various organizations from countries in the European Union. Genome Canada funding directly funds three of eight projects relevant to genomics. This funding is worth up to \$1 million over three years for a total of \$13.4 million with co-funding. (Genome Canada funding is recognized for supporting all nine projects with Canadian participants that were approved as part of the competition.) The three genomics-related projects focus on harmonizing phenomics information, improving the diagnosis and treatment of a cardiac arrhythmia syndrome, and studying a life-threatening autosomal skin disease to understand its pathophysiology, facilitating the development of targeted therapies. E-Rare-3 is enabling scientists in different countries to build effective collaboration around a common interdisciplinary research project based on the sharing of expertise, with a clear translational research approach.
- **Continued support for the Structural Genomics Consortium (SGC).** The SGC, established in 2004, is a not-for-profit public-private partnership that supports the discovery of new medicines through open access research. Throughout 2016-17, Genome Canada continued its investment in the SGC. Up to \$302.9 million in investments have been made in collaboration with our partners. The SGC, with the help of Genome Canada, developed a new partnership model that gives disease-specific foundations, like Myeloma UK and the CHDI Foundation, access to relevant chemical probes as they emerge from the SGC pipeline. To date, the SGC's contributions include solving and depositing into the public domain more than 1,700 novel human structures. More than 7,300 samples of chemical probes have been distributed by SGC or sold by third-party distributors.
- **Completion of most of the 2012 Bioinformatics and Computational Biology Competition projects.** Through this collaborative initiative with CIHR, a total of \$11.3 million has been invested in 17 research projects addressing current challenges in bioinformatics and computational biology. Next-generation tools and methodologies have been developed to help

the research community deal with the influx of large amounts of data produced by modern genomics technologies. The research community has received broad access to these new tools. The projects funded through this program are either finished or nearing completion. They have, to this point, produced 14 software programs or analysis tools and 23 publications, and provided research experience for 30 post-doctoral, graduate and undergraduate students.

- **Completion of the 2015 Bioinformatics and Computational Biology Competition, announcement of results and provision of funding.** Following on from the 2012 competition, the objectives of this competition, held in partnership with CIHR, remain the same: to support the development of next-generation tools and methodologies and to provide the research community broad and timely access to these tools. This competition will support the development of new software and database tools that will empower public health agencies and the agri-food sector to more rapidly respond to threats posed by infectious disease outbreaks such as, food-borne illnesses or the growing crisis of microbes resistant to antimicrobials and will bolster federal action on antimicrobial resistance through stronger surveillance, stewardship and innovation. Other projects will enhance diagnosis and treatment for patients, improve crops of importance to Canada, and strengthen environmental monitoring.
- **Continued investment in access to leading-edge technologies through technology platforms.** Throughout 2016-17, Genome Canada continued to support operations and technology development by investing up to \$57 million in its 10 technology platforms. The technology platforms provide the research community with the highest-quality genomics technologies and advice. Each of the platforms provides researchers access to high throughput genomics technologies such as DNA sequencing, proteomics and metabolomics, as well as new method and protocol development, data analysis and bioinformatics. Genome Canada also launched a new genomics technology platforms competition in July 2016. It will provide up to \$2 million per year over five years to each successful platform.
- **Completion of the 2015 Disruptive Innovation in Genomics Competition and provision of funding.** Genome Canada is investing \$18.5 million in projects that deliver innovations in the field of genomics. These projects are transformative in that they have the potential to either displace an existing technology, disrupt an existing market or create a new market. It is anticipated that disruptive innovations will enable the rapid acceleration of genomics research, marking a significant leap forward for the genomics revolution. Twenty projects were selected for funding under Phase 1 of this competition. Five projects were selected for funding in the first round of Phase 2.
- **Showcasing Canada's genomics enterprise at "Genomics on the Hill."** In February 2016, Genome Canada hosted, on Parliament Hill, a one-of-a-kind presentation about Canadian excellence in genomics research. The event was attended by over 200 guests, including numerous politicians. Parliamentarians had the opportunity to meet the leaders of some of Genome Canada's key projects in Canadian bioeconomy sectors such as health, environment, agriculture, fisheries and forestry, and to meet end users who talked about the impact of the research. This unique networking opportunity also helped enhance understanding of this complex research and raise awareness about this country's genomics successes and the potential to improve Canadians' lives and to provide new solutions to national and international challenges.
- **Showcasing Canada's genomics enterprise on the world stage.** At the BIO International Convention in San Francisco in June 2016, Genome Canada and the regional Genome Centres combined efforts to highlight our unique national and regional model, which is delivering innovative solutions to the issues facing Canadians in a globally competitive environment. The Convention annually attracts over 15,000 biotechnology and pharmaceutical leaders from around the globe, who come together for one week of intensive networking to discover new opportunities

and promising partnerships. This combined effort helps us gain visibility in front of influential decision-makers, form valuable partnerships and access high-level stakeholders.

- **Fostering evidence-based public policy and identification of timely, relevant research priorities.** Throughout 2016-17, Genome Canada undertook several activities to increase awareness among key target audiences of the value of genomics in society. The Genomics, Public Policy and Society (GPS) Series brokers a dialogue between federal policy-makers and researchers on issues that arise at the interface of genomics and society. The series is also intended to help foster evidence-based public policy and identify timely and socially relevant research priorities. Two GPS events were held in 2015. One was a presentation called *Can Genetically Modified Crops Help the Poor?*, focusing on the theme of genetically modified crops as a tool of agricultural development. It was presented in October at Dalhousie University. The other presentation took place in November at the Canadian Science Policy Conference in Ottawa. Called *Beating Superbugs: Innovative genomics and policies to tackle AMR*, it centred on antimicrobial resistance. Policy briefs developed for each of these events were published in spring 2016.
- **Bringing together provincial and territorial health authorities, researchers and other key opinion leaders to discuss strategies to advance implementation of genomics in the health-care system.** Genome Canada staff, in partnership with the Genome Centres and CIHR, are working together to advance the integration of genomics and health. One key activity in the development of a genomics and precision health strategy was the Genomics and Precision Health Forum, held on October 4 and 5, 2016, in Toronto. The 115 participants included provincial and territorial health authorities, and key national and international opinion leaders from academia, industry, patient groups and non-governmental organizations. Genome Canada staff also organized a satellite meeting prior to the forum that brought together people from projects funded in the 2012 LSARP Competition – Genomics and Personalized Health, as well as relevant GAPP projects. A brief report is being drafted.
- **Convening key stakeholders to discuss the current level of research and areas for potential collaboration in genomics and antimicrobial resistance.** Antimicrobial resistance is considered a global threat with significant implications for human health, livestock and the environment. Genome Canada, in partnership with the Canadian Food Inspection Agency, Genome Alberta and Genome British Columbia, organized the Forum on Genomics and Antimicrobial Resistance, held in Ottawa in February 2016. The forum focused on a “One Health” approach to tackling antimicrobial resistance across all sectors (agriculture, health and environment). The One Health approach seeks to improve health and well-being through preventative measures, including prevention of risks and mitigation of effects of crises that originate at the intersection between humans, animals, and their environments. The forum brought together more than 60 leading experts from academic, government, industry and commodities groups to address the challenge of antimicrobial resistance and discuss a path forward. A report of the meeting has been finalized and circulated to all participants and interested parties.
- **Advancing the understanding of the potential impacts and challenges of gene editing.** Genome Canada staff, along with representatives from Genome British Columbia, Health Canada, Agriculture and Agri-Food Canada and Fisheries and Oceans Canada, co-sponsored an Organisation for Economic Co-operation and Development (OECD) international symposium on gene editing. It was held in Ottawa on September 29 and 30, 2016. The symposium addressed the implications of gene editing across three pillars – health, agriculture/aquaculture and the environment – and brought together more than 100 key opinion leaders and Canadian and international regulators to discuss regulatory best practices. A report is being generated by OECD

staff and will be available by early 2017. Genome Canada also partnered with the University of Ottawa Institute for Science, Society and Policy to host a public forum on September 28 about the social implications of gene editing. The session was chaired by Eric Meslin, a member of the Science and Innovation Advisory Committee and the president and chief executive officer of the Council of Canadian Academies. Genome Canada staff are currently developing a strategy regarding future activities related to gene editing.

- **Informing future activities in the agriculture and agri-food sector.** Genome Canada, Genome Alberta, Genome Prairie and Genome British Columbia, in partnership with research funding agencies from Ireland, Northern Ireland and the United States, brought together academic and government researchers at the Smart Technologies for Sustainable Global Food Security Forum in Dublin, Ireland. The goal of the forum was to identify potential areas of investigation that would benefit from global collaboration. These included antimicrobial resistance, climate change and clean technology, animal health, animal production, sustainable crop production and soil-plant microbiome interactions. Genome Canada also began updating its 2013 genomics and agriculture sector strategy, in partnership with the regional Genome Centres.
- **Engaging in federal policy development.** In 2016-17, Genome Canada engaged in several activities related to federal policy development. These included:
  - engaging in discussions with, and submitting a response to, Canada's Fundamental Science Review,
  - participating in Innovation Roundtable panel discussions,
  - engaging with the advisory council on economic growth, and,
  - submitting a request for funding related to Canada's Innovation Agenda for consideration in the 2017 budget.

### **Successes and remaining challenges from 2016-17**

Genome Canada achieved considerable success in meeting its core mandate to lead the Canadian genomics enterprise. The organization continues to connect ideas and people across public and private sectors, invest in large-scale science and technology to fuel innovation, and support the translation of discoveries into application to maximize the positive impact of genomics across sectors, as articulated in the objectives of *Genome Canada Strategic Plan 2012–2017*. Through our funding and program activities, genomics research in Canada has continued to set a world standard, and its global influence has been enhanced through the funding of several international partnerships.

The principal challenge remaining from 2016-17 is **co-funding**. Year-to-year funding inhibits strategic investment planning and negatively impacts the ability of Genome Canada and the Genome Centres to secure co-funding. A multi-year funding commitment from the Government of Canada at a level that allows for the full implementation of the strategic plan would position Genome Canada as a stable and credible partner with industry and the provinces and territories. These essential co-funding partners require a multi-year planning horizon for the kind of large-scale and long-term investments that genomics research and innovation entails.

## 3.0 Planned Activities 2017-18

### Genome Canada's funds and initiatives

#### Delivering ongoing programs

For the 2017-18 fiscal year, Genome Canada will continue to manage ongoing programs and initiatives funded by the various agreements noted in Table 1. Table 2 also includes a list of all programs funded by Genome Canada that will be active in 2017-18.

Genome Canada continues to support research and innovation that address real-world challenges and have the greatest potential to generate social and economic benefits for Canadians. Growing and sustaining Canada's dynamic bioeconomy involves maintaining a balanced portfolio of funding for discovery and applied research to fuel innovation as well as funding for research that has advanced to the translational phase. Our approach ensures alignment and complementarity with other key members of Canada's science, technology and innovation ecosystem. This allows all involved to mutually reinforce strategies and objectives, and capitalize on synergies that can be derived from working together.

Positive impacts of genomics research on sectors important to Canada are beginning to be realized. The following section highlights some of the outcomes arising from our funding decisions.

#### HUMAN HEALTH

##### Saving lives and improving health care through personalized medicine

Genomics is driving a paradigm shift from a disease-oriented health-care system to one that is more precise, personalized, predictive, preventative and cost-effective. Canadian genomics research has already led to earlier and more accurate diagnoses, more effective treatments and improved health outcomes for patients touched by cancer, heart disease, autism, epilepsy, rare genetic disorders and other debilitating diseases.

##### Outcome examples

- An innovative procedure originating in the United Kingdom that allows quick and painless diagnosis of Barrett's syndrome was enhanced. Barrett's syndrome is a complication of gastroesophageal reflux disease. Genomics technologies will allow doctors to accurately assess patients over time. They will be able to provide early detection of patients progressing to cancer and enable preventative measures and effective early treatment, potentially saving the health-care system more than \$300 million a year.
- A platform – CARE4RARE – was developed that enables early and accurate diagnosis of rare diseases in children, avoiding the costly and stressful "diagnostic odyssey" for more than 300 Canadian families with affected children.
- A rapid diagnostic device in the evolving world of point-of-care diagnosis of tuberculosis and malaria was developed and implemented.
- Genomics tools were developed to pinpoint dozens of genetic variants responsible for autism, which affects one in 68 children. These tools will make it possible to categorize autism into subtypes, enabling earlier interventions, new treatment options and improved quality of life for these individuals and their families.
- A molecular test that differentiates between brain tumour subtypes in medulloblastoma patients – a disease that primarily affects children – was developed and implemented. The test promises to improve patient outcomes by enabling more effective treatments, reducing unnecessary side effects and avoiding over-treatment.

## **AGRICULTURE AND AGRI-FOOD**

### **Generating competitive production systems and innovative products**

Canada's agri-food sector employs some 2.2 million Canadians and Canada is among the world's leading exporters of food products. The agriculture and agri-food sector is well-positioned to use genomics to grow our share of the world's market as demand increases. Canadian genomics research is improving food quality, safety and security, and boosting production in crops and livestock. It is helping Canadian producers create high-value products, increase global market share, diversify exports, and preserve and create jobs here in Canada.

#### **Outcome examples**

- The genetics of Canadian beef and dairy cattle have been enhanced, resulting in improved productivity and value. Canada's dairy industry is realizing benefits of more than \$200 million per year through genomics-informed breeding for desirable traits.
- Genomics is being used to help honeybees adapt to and withstand the difficulties of Canadian winters. The ongoing loss of honeybees is a global threat to agriculture.
- Scientists are working to identify what it is about wild sunflowers that allow them to better withstand drought, flooding, salt and low nutrition levels to boost domestic sunflower production. Sunflowers are a \$20-billion crop and the only oilseed in the Global Crop Diversity Trust's list of 25 priority food security crops.
- New traits are being incorporated in crops like spring wheat and barley, allowing them to withstand early and late frosts.
- The impact of diseases afflicting pigs is being reduced. These diseases together cost the Canadian pork industry \$100 million in losses each year.
- A benchtop device that allows meat food processors to rapidly detect *E. coli* contamination is safeguarding food from contaminants and preventing lengthy and costly production issues.
- Understanding the genomics of grape ripening and yeast fermentation has helped improve wine quality and vineyard operations.
- High-value plant metabolites that have applications as pharmaceuticals, cancer drugs, industrial chemicals and more are being produced. One example is the development of a new Ebola vaccine that is produced from tobacco plants.

## **FORESTRY**

### **Making the sector more profitable and sustainable**

Canada has one of the best conifer genomics platforms in the world and is well positioned to apply genomics-based tools to support the development of productive and healthy forests. Our research is helping to offset the impacts of pests (such as mountain pine beetle) and pathogens, boost forest productivity, monitor biodiversity and track invasive species for trees of economic importance, such as the white spruce and balsam fir. Further, it is seen as a powerful enabler in diversifying the forest industry from pulp, paper and lumber into a high-margin bioproducts-based industry.

#### **Outcome examples**

- Genomic screening has helped forest managers in Quebec select white spruce seedlings with increased growth characteristics and better quality wood, which will lead to greater productivity of the forest sector both locally and globally.
- An insect virus product was created to control the balsam fir sawfly in Newfoundland and Labrador. This could potentially save 25 per cent of useable trees in New Brunswick alone.

- Blister rust-resistance genes in western white pine have been identified and pollen from resistant trees has been used to create clean seedlings for coastal reforestation in British Columbia.
- Microbial communities developed for pulp and paper mills have reduced harmful bioproducts and produced power for operations, thereby making mills more efficient while increasing their social licence to operate.
- “Enzyme cocktails” that degrade and convert biomass more efficiently have been produced, improving biofuel economics.
- New tools have been created to genetically improve poplar trees as a Canadian bioenergy feedstock.
- Genomics and climate mapping information have been drafted that is helping provincial forestry agencies in British Columbia and Alberta structure policy for tree planting to match the best tree seed to the environment, taking into account climate change.

## **FISHERIES AND AQUACULTURE**

### **Enhancing production, protecting fish and ecosystems**

Genomics is driving growth in the sector by helping to improve fish production, decrease loss from disease and pests, increase traceability and optimize feed formula for healthy, profitable and sustainable fish farms. Further, genomics offers powerful tools to monitor wild fish stocks for biodiversity, genetic origins and population health. It is providing critical information for the regulation of fisheries, leading to healthy and sustainable ecosystems.

#### **Outcome examples**

- Producers are enjoying a 20 per cent reduction in grow-out time for halibut because of genomic research results, which has led to a quicker time to market and greater profitability.
- A multi-year international collaboration involving Canadian researchers sequenced the Atlantic salmon genome, which has provided the foundation for the industry’s use of marker-selected breeding.
- Researchers have determined that the use of genetically modified Camelina – a plant with high oil content – can be used as a partial replacement for fish oil and fish meal in aquaculture feeds where the current demand cannot be met with traditional methods.
- Researchers have identified the genomic signature associated with increased mortality in migrating Fraser River sockeye salmon, signaling that more research is needed on infectious diseases among wild stocks.
- Producers can now reduce losses in Atlantic salmon, armed with research that uses marker-assisted selection to develop strains of Atlantic salmon resistant to infectious pancreatic necrosis.
- Researchers have developed health assessment tools for marine mussels. These can also be used to indicate environmental stressors such as climate change and pollution.

## **ENVIRONMENT**

### **Maintaining a clean, safe and sustainable environment**

Genomics is equipping Canada to preserve a clean, safe and sustainable environment through the development of technologies to monitor and manage the effects of human and climate impact as well as invasive species. Canada is recognized for its global leadership in biodiversity science, breakthroughs in furthering understanding of economically and ecologically important trees, and development of new tools to de-contaminate polluted sites.

## **Outcome examples**

- KB-1®, a microbial culture used to enhance the clean-up of contaminated groundwater, was refined through Canadian genomics research and is the first product of its kind licensed in Canada. It is used at hundreds of sites worldwide.
- Genomics is being employed to assess and mitigate the environmental impacts of the Mount Polley Mine tailings spill.
- Genomics tools have been used in Alberta's Wood Buffalo National Park to assess biodiversity around the oil sands and produce a baseline upon which to measure the effects of the oil sands. Environment and Climate Change Canada is now using these tools in the Canadian Aquatic Biomonitoring Network.
- Tools to identify how organisms respond at a genetic level to toxic substances in the environment are being explored.

## **ENERGY**

### **Providing tools to increase productivity in an environmentally sustainable way**

Canada is the world's fifth largest oil producer. The sector can be advanced by integrating new genomics-based technologies into existing processes. For example, one of the greatest challenges is the amount of hot water used to extract bitumen from oil sands (the average ratio is 3:1). This is straining water and energy resources and generating considerable waste for storage in tailings ponds. Genomics knowledge of microbial processes involved in both hydrocarbon extraction and waste remediation is helping to improve the management of water use, recycling and treatment in the energy industry.

## **Outcome examples**

- An energy company changed its plan of action based on knowledge that emerged (through the use of genomics tools) about risks caused by microbes in its tailings ponds.
- Microbes that are important in the processing of material extracted from the oil sands have been identified. Understanding the biological activity will allow for the development of more efficient processes.
- Microbes that accelerate the corrosion of pipelines have been identified. This will enable the development of methods to control these microbes, making pipelines safer.
- Understanding the role of microbes during liquid natural gas extraction provides information to develop sustainable processes and reduce impact on the environment.

## **MINING**

### **Boosting Canada's outputs and advancing international leadership**

Genomics research is underway in Canada that aims to improve industrial mineral extraction and processing. Further, genomics tools are providing new strategies to help manage and clean up contaminants, and control acid rock drainage and the unwanted leaching of metals. The applications of and opportunities for genomics in the sector are just starting to be recognized. This is a tremendous growth area for both research and industry.

## **Outcome examples**

- Acid mine drainage is a common problem in mining sites. Genomics is being used to identify microbes that are involved in remediation, providing sustainable solutions to a huge liability for the industry.

- DNA barcoding, a genomics tool for assessing biodiversity, is being used by British Columbia mining company New Gold to evaluate the impact of its operations on the environment and develop sustainable processes.
- Microbes to leach metals from mine waste are being identified. A one per cent increase in the amount of metal retrieved before the waste is discarded would lead to millions of dollars in profitability for Canadian mining companies.
- Tools are being developed to monitor and improve mine drainage treatment.
- There is better understanding of the biological processes involved in the breakdown of pollutants at contaminated mining sites.

## **Project and program planning 2017-18**

In its 2016 federal budget, the Government of Canada provided Genome Canada with a contribution of \$237.2 million. This contribution allows Genome Canada to pursue new endeavours and continue to support its current programs, as agreed to in prior agreements with Innovation, Science and Economic Development Canada.

### **Large-scale science**

#### **LSARP**

Continuing its ongoing support of large-scale genomics science in Canada, Genome Canada has allocated a minimum of \$74 million to the design and launch of two LSARP competitions over the next three years. Genome Canada's strategy to support large-scale research projects organizes sectors into three groups – human health, agriculture/agri-food and fisheries/aquaculture, and natural resources and the environment – with competitions for each group launched approximately 18 months apart. The timing proposed for the current funding aligns with the end date of the projects funded in the corresponding LSARP competition in the previous five-year cycle (2012-17). This gives the large research teams the opportunity to compete for new funding, and, if successful, prevent the dissolution of teams that have been built – maximizing previous investments. The level of funding proposed for each competition is similar to the amount invested in the previous cycle and reflects the relative level of maturity and capacity for each sector.

#### **2017 LSARP Competition – Genomics and Precision Health**

During the period covered by this current corporate plan, Genome Canada intends to launch the 2017 LSARP Competition – Genomics and Precision Health. Genome Canada has earmarked \$44 million for this competition, which will open in January 2017 with decisions anticipated by December 2017. The 2017 LSARP competition will support projects that demonstrate how genomics-based research can contribute to a more evidence-based approach to health that improves health outcomes and/or enhances the cost-effectiveness of the health-care system. Applicants must demonstrate how their proposal could produce concrete deliverables by the end of the funding period that would subsequently be translated into valuable clinical tools or improved health-care policies and practices.

As is Genome Canada's regular practice, a panel of international experts will scrutinize projects to ensure the quality and feasibility of the research proposed. Once approved, each project will be actively monitored and managed. This includes a biannual review by a research oversight committee that reports to the Genome Centres and Genome Canada on progress made by each project. These committees make recommendations on continued funding and provide guidance and advice to the research team to ensure the project meets its milestones within the framework of the approved budget.

#### **2018 LSARP Competition – Genomics and Agriculture, Agri-Food, Fisheries and Aquaculture**

The second LSARP Competition will support projects using genomics to address challenges and opportunities in the agriculture and agri-food sector, as well as the fisheries and aquaculture sector. With an investment of \$30 million, this competition will be under design in 2017-18 with an anticipated launch in June 2018 and decisions expected by June 2019. As the planning has yet to commence, the 2017-18 corporate plan includes only the forecast costs for the consultation and design of this future LSARP competition.

Genome Canada plans to develop updated strategies for these sectors by consulting key stakeholders, including relevant government departments and agencies, the private sector and leading researchers. These strategies will inform Genome Canada and the Genome Centres as we develop the request for

applications leading up to a decision by the board of directors on the competition's objectives and parameters.

### **Strategic initiatives**

Up to \$24 million has been allocated to strategic research priorities determined by the Genome Canada board of directors. Genome Canada remains committed to supporting national and international initiatives and emerging and regional issues. As such, funds will be set aside to contribute to the following.

- **National and international strategic initiatives on topics of strategic importance to Canada.** The ongoing successful development of strategic national and international partnerships demonstrates that the value and strength of both the Canadian genomics research community and Genome Canada are recognized around the world.
- **An emerging issue or opportunity requiring immediate attention and timely resolution.** This situation requires, in turn, a funding program that is flexible, responsive and nimble. Applications for emerging issues are accepted on an ad hoc basis and decisions can be taken within a few weeks, depending on the nature and complexity of the issue. Genome Canada's emerging issues program provides up to \$250,000 from Genome Canada plus co-funding from other sources for up to two years. Projects funded to date are usually in response to issues brought to Genome Canada's attention or initiated by a Genome Centre.
- **The Regional Priorities Partnership Program.** This new initiative, to be launched, is designed to build capacity in areas of priority to Canada's regions. The Regional Priorities Partnership Program will support the regional Genome Centres in their efforts to catalyze partnerships with relevant regional organizations, such as industrial firms, health-care authorities and natural resource managers, and attract co-funding. This will be an opportunity to strengthen relationships with provincial, territorial and regional partners and participate in initiatives that, in time, could feed into other Genome Canada programs and objectives. Initiatives could range from small-scale, short-term emerging issues and opportunities to large-scale applied research projects and technology platforms. The program could also support the development of projects that bring research to a stage where a user is willing to invest in translation and application through, for example, GAPP.
- **The SGC.** The SGC's core mandate is to determine the three-dimensional structures of human proteins of therapeutic relevance to diseases and to place them in the public domain so that industry and academia can have unrestricted use of them. The SGC also collaborates closely with eight pharmaceutical companies to generate new chemical probes (inhibitors or other modulators of protein function) for the next generation of targets of therapeutic interest. The focus is on epigenetic target proteins and protein kinases. The SGC also works with disease-specific foundations to provide them access to relevant chemical probes emerging from the SGC pipeline. Disease foundations also gain access to the SGC and industry scientists. This enables discoveries to be translated into cures as rapidly as possible.

### **Technology**

Genome Canada will continue to support leading-edge technologies that enable Canadian genomics research, including technology platforms, technology development, and bioinformatics and computational biology.

## **Technology platforms and technology development**

The goal of the 10 technology platforms is to provide researchers with access to high throughput genomics technologies such as DNA sequencing, RNA gene expression, protein identification and quantitation, and metabolomics. Access to new method and protocol development, data analysis and bioinformatics is provided as well. Each platform also assists researchers in the development of research proposals by providing advice on appropriate technologies, study design, data analysis and bioinformatics that enable and improve the quality of the research. The platforms develop new and improved genomics technologies, too, ensuring that the services they provide can support cutting-edge genomics research.

Currently, under a new agreement, up to \$45 million will be invested over three years in support of operations and technology development at genomics technology platforms. This reflects the desire to meet the needs, and ensure the continued success, of genomics research projects funded by Genome Canada and other organizations. Genome Canada will launch an open competition for funding from April 1, 2017, to March 31, 2020. An additional two years of funding (April 1, 2020, to March 31, 2022) will be made available subject to the successful outcome of an interim review of each platform and Genome Canada securing additional funds. The latter will enable technology platforms to develop new and improved technologies to ensure that the platforms remain at the forefront in providing Canadian researchers with access to leading-edge genomics technologies.

## **Bioinformatics and computational biology**

Bioinformatics and computational biology competitions support the development of next-generation tools and methodologies required by the research community to deal with the influx of large amounts of data produced by modern genomics technologies. The competitions also strive to ensure that the research community has broad access to these new tools. Genome Canada proposes to launch at least one competition with \$12 million in funds from a current agreement with Innovation, Science and Economic Development Canada.

## **Translation**

### **GAPP**

This Genome Canada program was designed to increase collaboration between genomics scientists and users of genomics research, as well as to stimulate investment from private and public partners in Canadian solutions that address real-world challenges and opportunities in the field of genomics. Since its launch in 2013, GAPP has experienced phenomenal success in terms of participation across sectors. Thirty-one projects are currently underway with users focusing on applications as diverse as novel therapeutics, greener automobile manufacturing, improved feed for fish, poultry and swine, enhanced cheese quality and personalized diagnostic tools for lung transplantation and other diseases. It is clear that Canadian sectors are primed to integrate genomics to drive innovation, foster sustainable practices and power the growth of their businesses. Further, through a partnership with Mitacs, GAPP projects are helping train the next generation of entrepreneurs to advance genomics in Canadian industries of the future.

Genome Canada will increase its investment in GAPP. It proposes offering \$45 million for funding opportunities every six months between 2017 and 2020, resulting in up to six rounds. Funding will also be used to engage with sector stakeholders to develop their understanding of the value of genomics to their sector. In preparation for another phase of GAPP funding, Genome Canada and the Genome Centres carried out a review of GAPP based on experience gained after the first six rounds between 2013 and

2016. While the overall design and objectives of the program remain essentially the same, some changes are being made to the investment strategy and guidelines, and to the processes for application, review and post-award monitoring. These changes will further enhance the effectiveness and efficiency of the program.

### **Translational networks**

Genome Canada is developing a new program, the Translational Networks Program, to facilitate collaborations and dialogue between researchers and other key stakeholders whose sectors stand to be transformed by genomics advances. The program is being designed to enhance the GE<sup>3</sup>LS research undertaken by funded LSARP projects, focusing on common challenges and barriers to translating the research into use. This will ensure the effective and responsible translation of innovative genomics applications.

The uptake of genomics-based innovations can be affected by various social, economic and environmental factors, including legal and regulatory requirements, especially when they represent significant changes to current practices. Already, GE<sup>3</sup>LS research conducted through LSARP competitions helps us better understand these factors – primarily in the context of individual projects but also in relation to sectors.

Specifically, the Translational Networks Program will strengthen the connections between researchers, users and other stakeholders on issues that could impact the uptake and application of genomics technologies, including commercialization. Connections will be strengthened through networks that:

- add support to, and enhance, the GE<sup>3</sup>LS research undertaken by funded LSARP projects,
- accelerate the synthesis and dissemination of research pertinent to users, including policy-makers and opinion leaders, and
- tackle challenges common to the funded research projects.

The first such network is underway in support of the LSARP projects funded through the 2012 LSARP Competition – Genomics and Personalized Health. The network activities will help ensure that evidence produced through projects is accessible and actionable, and can accelerate the responsible uptake of genomics innovations.

### **Developing sector strategies**

Genome Canada staff, in partnership with the regional Genome Centres and other key stakeholders, will be working to update sector strategies in two areas: agriculture and agri-food, and health. A new agriculture and agri-food sector strategy will build upon the 2013 sector strategy and will take place in partnership with the Genome Centres as well key federal departments such as Agriculture and Agri-Food Canada. To develop a new health strategy, staff will partner with the Genome Centres and key stakeholders such as CIHR, Health Canada and provincial and territorial health authorities to advance the integration of genomics into health-care systems. This will build on activities undertaken in 2016-17 such as the Genomics and Precision Health Forum, as well as the launch of the 2017 LSARP Competition – Genomics and Precision Health.

## **Building external relations and communicating Genome Canada's activities**

Genome Canada continues to work closely with the regional Genome Centres to promote the power and promise of genomics, and convey diverse stories about genomics' impacts across multiple sectors of importance to Canada.

We are working collectively within the genomics enterprise and with other networks to celebrate Canadian genomics during Innovation150 – an initiative celebrating Canadian science, technology and innovation as part of Canada's sesquicentennial.

Looking forward, Genome Canada will continue to maintain and develop national and international partnerships in areas of pressing importance to Canadians. Genome Canada is investigating potential partnerships with our American counterparts around issues of climate change and, more broadly, with the international community, engaging in constant communication around rare diseases and precision medicine in terms of research and data harmonization.

We also continue to showcase genomics science on the international stage. Genome Canada plans to attend the 2017 BIO International Convention in San Diego in June 2017. BIO allows Genome Canada and the Genome Centres a week of intensive networking to discover new opportunities and promising partnerships. This is in addition to our participation at other national and international events and conferences planned for the year ahead.

Genome Canada recently underwent a brand refresh. This included strengthening our narrative vis-à-vis communicating the benefits of genomics to Canadians and modernizing our "look and feel." We also introduced a suite of new corporate communications tools, including a revamped website and expanded engagement on social media. With more than 5,000 followers on Twitter and a growing community on Facebook and LinkedIn, Genome Canada will continue to broaden its digital reach and levels of public and stakeholder engagement through these tools.

Genome Canada, in collaboration with its board of directors, recently created a communications and outreach committee as a permanent committee of the board. The role of the committee is to provide high-level strategic advice on matters related to communications, advocacy (including education) and stakeholder relations. Its function will ensure effective strategies are in place to meet the needs of Genome Canada in communicating its mission, vision and mandate.

## 4.0 Finance Management

The federal government, through Innovation, Science and Economic Development Canada, has committed \$1.4 billion in funding to Genome Canada since 2000-01, including the most recent support of \$237.2 million in Budget 2016. All funding is provided through funding agreements between Genome Canada and Innovation, Science and Economic Development Canada. Genome Canada and the Genome Centres raise co-funding from others, including the public, not-for-profit and private sectors.

### Investment and management of funds

The audit and investment committee supports Genome Canada's board of directors in fulfilling its fiduciary responsibilities with respect to the management of funds. The committee meets quarterly and reports to the board on the outcome of its deliberations.

The committee is responsible for:

- overseeing the investment and management of funds received from the Government of Canada as per a board-approved investment policy that outlines guidelines, standards and procedures for the prudent investment and management of funds, and
- overseeing Genome Canada's policies, processes and activities in the areas of accounting and internal controls, risk management, auditing and financial reporting.

The board's programs committee brings further oversight to the management of funds by ensuring research funding and activities are aligned with Genome Canada's strategic priorities. The committee provides advice to the board of directors on research programs and projects, research partnerships and collaborations, competitions and program evaluation.

### Source and use of funds

Genome Canada currently manages funds arising from the following funding agreements.

**TABLE 1: GENOME CANADA FUNDING AGREEMENTS WITH INNOVATION, SCIENCE AND ECONOMIC DEVELOPMENT CANADA**

| Federal budget                        | Competitions and projects funded   |
|---------------------------------------|--|
| <b>Budget 2008</b><br>(\$140 million) | Competition in applied genomics research in bioproducts and crops<br>Two research projects through the Cancer Stem Cell Consortium and the International Barcode of Life project<br>Support for the science and technology innovation centres (now the Genomics Innovation Network), the operations of six regional Genome Centres and Genome Canada through to 2012-13  |
| <b>Budget 2010</b><br>(\$75 million)  | Competition in forestry and the environment<br>Multi-sector competition<br>Competition for operations support for the Genomics Innovation Network  |
| <b>Budget 2011</b><br>(\$65 million)  | Competition in applied genomics research in personalized health<br>Funding of Phase III of the Structural Genomics Consortium (SGC) and continued funding for the International Barcode of Life project<br>Funding for the Public Population Project in Genomics<br>Competition in bioinformatics and computational biology<br>Contribution to the operations of six regional Genome Centres and Genome Canada for 2013-14 |
| <b>Budget 2012</b><br>(\$60 million)  | Funding for the Genomic Applications Partnership Program<br>Funding for renewal of the Genomics Innovation Network for two years<br>Funding of the SGC and the International Barcode of Life project   |

| Federal budget                          | Competitions and projects funded   |
|---|--|
| <b>Budget 2013</b><br>(\$165 million)   | Two competitions in large-scale applied genomics research<br>Funding for Genomics Innovation Network operations in 2015-16 and 2016-17, as well as related technology development<br>Funding for disruptive innovation in genomics and in bioinformatics and computational biology<br>Funding for national and international partnerships, including the SGC and the International Barcode of Life project<br>Contribution to the operations of six regional Genome Centres and Genome Canada through to 2016-17 |
| <b>Budget 2016</b><br>(\$237.2 million) | Two competitions in large-scale applied genomics research<br>Support for genomics technology platforms and for bioinformatics and computational biology competitions<br>Funding for the Genomic Applications Partnership Program<br>Funding for national and international partnerships and strategic initiatives<br>Contribution to the operations of six regional Genome Centres and Genome Canada through to 2019-20  |

### Cash management

Genome Canada disburses funds on a quarterly basis through the six regional Genome Centres (for approved research projects) and the Genomics Innovation Network. On a quarterly basis, each Genome Centre is required to review the expenditures to date and estimate cash requirements for centre operations and for each project and innovation centre that it manages. It then submits a “draw request” to Genome Canada, indicating the cash needs for the subsequent quarter. The Genome Centres assess the project/innovation centre needs against the approved budget, actual expenditures, scientific progress to date and co-funding received from other sources. Genome Canada then conducts its own thorough review of the draw request submission before releasing funds.

### Receipts and disbursements

Table 2 on the following page provides an estimate of the receipts and disbursements for the funding agreements.

**TABLE 2: SUMMARY OF RECEIPTS AND DISBURSEMENTS**

| Details<br><i>(in millions of dollars)</i>                                  | Genome Canada      |                     |                     |                             |                |                             | Total                                  |               |
|---|--------------------|---------------------|---------------------|-----------------------------|----------------|-----------------------------|--|---------------|
|   | Actuals<br>2000-16 | Forecast<br>2016-17 | Forecast<br>2017-18 | Forecast<br>Future<br>years | Total          | Estimated<br>co-<br>funding | Genome<br>Canada<br>and co-<br>funding | %             |
| <b>RECEIPTS</b>   |                    |                     |                     |                             |                |                             |  |               |
| Government of Canada  |                    |                     |                     |                             |                |                             |  |               |
| Previous budgets  | 700.0              |                     |                     |                             | 700.0          |                             | 700.0                                  | 19.2%         |
| Budget 2008   | 133.8              | 4.5                 | 1.7                 |                             | 140.0          |                             | 140.0                                  | 3.8%          |
| Budget 2010   | 75.0               |                     |                     |                             | 75.0           |                             | 75.0                                   | 2.1%          |
| Budget 2011   | 57.1               | 7.9                 |                     |                             | 65.0           |                             | 65.0                                   | 1.8%          |
| Budget 2012   | 55.0               | 5.0                 |                     |                             | 60.0           |                             | 60.0                                   | 1.6%          |
| Budget 2013   | 61.8               | 49.5                | 22.0                | 31.7                        | 165.0          |                             | 165.0                                  | 4.5%          |
| Budget 2016   | 0.0                |                     | 35.4                | 201.8                       | 237.2          |                             | 237.2                                  | 6.5%          |
| Investment income   | 89.5               | 0.2                 | 0.1                 |                             | 89.8           |                             | 89.8                                   | 2.5%          |
| Co-funding  |                    |                     |                     |                             |                | 2,112.4                     | 2,112.4                                | 58.0%         |
|   | <b>1,172.2</b>     | <b>67.1</b>         | <b>59.2</b>         | <b>233.5</b>                | <b>1,532.0</b> | <b>2,112.4</b>              | <b>3,644.4</b>                         | <b>100.0%</b> |
| <b>DISBURSEMENTS</b>  |                    |                     |                     |                             |                |                             |  |               |
| <b>Research projects and Genome Centres funding</b>                         |                    |                     |                     |                             |                |                             |  |               |
| Projects and programs completed in previous years                           | 848.3              | 0.0                 | 0.0                 | 0.0                         | 848.3          | 1,062.8                     | 1,911.1                                | 52.4%         |
| 2012 Large-Scale Applied Research Project: Genomics and Personalized Health | 33.0               | 13.9                | 0.0                 | 0.0                         | 46.9           | 111.7                       | 158.6                                  | 4.4%          |
| 2014 LSARP: Genomics and Feeding the Future                                 | 4.0                | 9.3                 | 9.3                 | 10.0                        | 32.6           | 62.0                        | 94.6                                   | 2.6%          |
| 2015 LSARP: Natural Resources and the Environment                           | 0.0                | 3.5                 | 10.0                | 21.0                        | 34.5           | 77.7                        | 112.2                                  | 3.1%          |
| 2017 LSARP and 2018 LSARP   | 0.0                | 0.0                 | 0.0                 | 74.0                        | 74.0           | 148.0                       | 222.0                                  | 6.1%          |
| Genomic Applications Partnership Program                                    | 10.8               | 15.1                | 13.5                | 43.4                        | 82.8           | 175.3                       | 258.1                                  | 7.1%          |
| Translational Networks  | 0.0                | 0.0                 | 0.0                 | 3.0                         | 3.0            | 6.0                         | 9.0                                    | 0.2%          |
| GE <sup>3</sup> LS Third Modality   | 0.0                | 1.0                 | 0.0                 | 0.0                         | 1.0            | 1.0                         | 2.0                                    | 0.1%          |
| Bioinformatics and Computational Biology                                    | 4.4                | 2.7                 | 0.0                 | 12.0                        | 19.1           | 32.3                        | 51.4                                   | 1.4%          |
| Strategic Initiatives   | 0.2                | 3.4                 | 0.4                 | 13.5                        | 17.5           | 48.2                        | 65.7                                   | 1.8%          |
| Advancing Big Data Science  | 0.8                | 0.5                 | 0.5                 | 0.2                         | 2.0            | 4.0                         | 6.0                                    | 0.2%          |
| Emerging Issues   | 0.7                | 0.3                 | 0.0                 | 0.0                         | 1.0            | 5.9                         | 6.9                                    | 0.2%          |
| Global Alliance for Genomics and Health                                     | 0.2                | 0.8                 | 0.0                 | 0.0                         | 1.0            | 2.3                         | 3.3                                    | 0.1%          |
| Structural Genomics Consortium IV   | 1.0                | 1.3                 | 3.1                 | 7.1                         | 12.5           | 27.1                        | 39.6                                   | 1.1%          |
| International Barcode of Life   | 15.6               | 0.6                 | 0.0                 | 0.0                         | 16.2           | 36.6                        | 52.8                                   | 1.4%          |
| Cancer Stem Cells Consortium  | 15.7               | 4.9                 | 2.4                 | 0.0                         | 23.0           | 68.0                        | 91.0                                   | 2.5%          |
| Genomics Innovation Network   | 9.6                | 14.8                | 15.0                | 30.0                        | 69.4           | 77.6                        | 147.0                                  | 4.0%          |
| Disruptive Innovation in Genomics   | 0.0                | 3.0                 | 4.0                 | 8.0                         | 15.0           | 20.5                        | 35.5                                   | 1.0%          |
| Canadian Epigenetics Environment  | 0.0                | 1.0                 | 0.0                 | 0.0                         | 1.0            | 1.0                         | 2.0                                    | 0.1%          |
| Genome Centres' operations  | 82.6               | 4.8                 | 4.8                 | 9.6                         | 101.8          | 144.4                       | 246.2                                  | 6.7%          |
|   | <b>1,026.9</b>     | <b>80.9</b>         | <b>63.0</b>         | <b>231.8</b>                | <b>1,402.6</b> | <b>2,112.4</b>              | <b>3,515.0</b>                         | <b>96.5%</b>  |
| <b>Genome Canada operations</b>   | <b>101.3</b>       | <b>7.0</b>          | <b>6.6</b>          | <b>13.2</b>                 | <b>128.1</b>   | <b>0.0</b>                  | <b>128.1</b>                           | <b>3.5%</b>   |
| <b>Total disbursements</b>  | <b>1,128.2</b>     | <b>87.9</b>         | <b>69.6</b>         | <b>245.0</b>                | <b>1,530.7</b> | <b>2,112.4</b>              | <b>3,643.1</b>                         | <b>100.0%</b> |
| <b>Excess receipts over disbursements</b>                                   | <b>44.0</b>        | <b>-20.8</b>        | <b>-10.4</b>        | <b>-11.5</b>                | <b>1.3</b>     |                             |  |               |
| <b>Opening cash balance</b>   | <b>0.0</b>         | <b>44.0</b>         | <b>23.2</b>         | <b>12.8</b>                 |                |                             |  |               |
| <b>Closing cash balance</b>   | <b>44.0</b>        | <b>23.2</b>         | <b>12.8</b>         | <b>1.3</b>                  | <b>1.3</b>     |                             |  |               |

## 5.0 Risk Assessment and Mitigation Measures

Genome Canada has a wide array of policies, systems and processes that have been developed over time to address issues of risk assessment and mitigation strategies, as well as ongoing performance and evaluation monitoring. The *Performance, Evaluation, Risk, Audit Framework* was approved by the board of directors in December 2015.

### Risk management

Risk management is integrated into all of Genome Canada's operational, managerial and governance activities. A formal risk management framework is in place and is annually updated and approved by the board of directors. Strategic risks arising from the external operating environment as well as the internal operating environment are assessed on an ongoing basis.

- At the project selection level, risk is managed and mitigated through a process that restricts funding to only those projects judged to have the greatest probability of success from both a scientific and managerial point of view. The viability of each project's success is further mitigated through ongoing monitoring and reviews.
- At the operational level, officers of Genome Canada identify risks and propose strategies for mitigating and reporting (for example, due diligence routines for review of draw requests and for reviews of funded projects).
- At the managerial level, policies, systems, processes and procedures (administrative, financial, human resource management) are developed, implemented and monitored.
- At the governance level, the board of directors and its committees are aware of their risk management responsibilities and exercise modern governance practices with respect to policy approval and oversight.
- The audit and investment committee is responsible for the monitoring of risk and mitigation strategies and regularly reviews the organization's corporate risk profile.
- The Genome Canada internal working environment culture is one that values honesty, integrity and ethical conduct.

### Annual audit

The annual audit of Genome Canada's financial statements is conducted in accordance with generally accepted Canadian auditing standards. The statements are filed with Innovation, Science and Economic Development Canada by July 31 of each fiscal year. The objective is to express an opinion on whether Genome Canada's financial statements present fairly – in all material respects – the financial position, results of operations and cash flow of the corporation. Upon completion of the audit, the financial statements and a summary of audit findings are presented to the audit and investment committee and then to the board of directors for approval. The financial statements can be found on the Genome Canada website ([www.genomecanada.ca](http://www.genomecanada.ca)).

### Recipient audit

Genome Canada has developed and implemented a recipient audit framework in consultation with the Genome Centres. As part of this exercise, a risk assessment tool was developed to enable the Genome Centres to identify projects, including the Genomics Innovation Network, that would undergo a detailed compliance audit. This framework was introduced to bring a common approach to recipient audits across Canada and to improve the management control framework within which genomics research is administered.

## **Compliance audit**

In fiscal year 2011-12, then-named Industry Canada, as a routine practice, initiated a compliance audit of Genome Canada. It was conducted by an independent accounting firm. The stated objective of the audit was to assess Genome Canada's compliance with the requirements of the funding agreement that was in effect in fiscal year 2010-11. The resulting audit report concluded that "...we are of the opinion that GC (Genome Canada) did comply with the requirements of its funding agreement with Industry Canada."

## **Evaluation**

The terms and conditions of Genome Canada's funding agreements with Innovation, Science and Economic Development Canada specify that every five years, Genome Canada shall carry out an independent third-party evaluation of its grants to eligible projects, including its own activities and projects. The terms and conditions further state that the evaluation will measure overall performance in achieving the objectives identified in the funding agreement. In 2008-09, Genome Canada underwent a full third-party summative evaluation to determine to what extent it had achieved its objectives and mandate. The evaluation concluded that, overall, the rationale for Genome Canada remains strong and important, and that there has been a "transformative" impact of Genome Canada on Canadian genomics research. The second five-year evaluation of Genome Canada was completed in March 2014. The five-year evaluation assessed Genome Canada's relevance and performance from 2009-10 to 2013-14. The evaluation's findings helped inform management and other stakeholders on progress and how to best implement the organization's strategic direction going forward.

## ACKNOWLEDGEMENT

### **Government of Canada**

Genome Canada would like to thank the Government of Canada for its support.



**Genome**Canada

150 Metcalfe Street, Suite 2100  
Ottawa, Ontario K2P 1P1  
Telephone: 613-751-4460  
Facsimile: 613-751-4474  
Email: [info@genomecanada.ca](mailto:info@genomecanada.ca)  
Website: [www.genomecanada.ca](http://www.genomecanada.ca)