



BACKGROUND

Results of Genomics Technology Platforms 2016 Competition for Operations Support and Technology Development Funds

Genome Canada and partners are pleased to invest approx. \$93 million in funding over three years in 10 genomics technology platforms (\$45 million from Genome Canada and \$48 million from partners including provincial governments, not-for-profit organizations and the private sector). The funding will enable the platforms to develop new and improved genomics technologies, and provide researchers across Canada and internationally with access to leading-edge genomics tools, technologies and services, which improve the quality of research.

BRITISH COLUMBIA

The Pan-Canadian Proteomics Centre

Platform Leaders: Christoph Borchers (University of Victoria), Leonard Foster (University of British Columbia)

Genome Centre: Genome British Columbia

Total funding: \$11.1 million

The Proteomics Centre has been providing an extensive range of cutting-edge proteomics services for more than 15 years, during which time clients from across Canada and in more than 15 countries have accessed its services on a fee-for-service or collaborative basis. The Proteomics Centre is now the best-equipped proteomics research facility in Canada.

With new funding from Genome Canada, the Proteomics Centre will expand to be a truly pan-Canadian enterprise. The Centre will establish a new node at Toronto's Hospital for Sick Children, as well as a new site for clinical proteomics at Montreal's Jewish General Hospital. This new Pan-Canadian Proteomics Centre will broaden in-house technological expertise, increase the range of technologies offered, increase capacity for core service provision and build a vital network of key collaborators. It will have a greater emphasis on translation of technologies into real-world applications and tighten linkages to clinical facilities. It has secured more than 60 projects, worth more than \$7.8 million, for 2017-2022. It will develop and implement more than 1,400 new assays, extend or add value to 20 existing services, translate 150 assays into clinical settings, introduce 20 new crosslinkers, launch 11 new software tools and venture into new technology development areas, including proteogenomics.

BC Cancer Agency Genome Sciences Centre Genomics Technology Platform

Platform leaders: Marco Marra, Steven Jones (BC Cancer Agency) Corey Nislow, Martin Hirst (University of British Columbia)

Genome Centre: Genome British Columbia

Total funding: \$9.6 million

The sequencing and bioinformatics analysis platforms at Canada's Michael Smith Genomic Sciences Centre have operated as a Genome Canada platform since 2001. In that time, its technical ability to deliver successful collaborations and service arrangements has led to its involvement in 705 grants and contracts totaling more than \$875 million, and supporting the work of more than 1,500 researchers, both nationally and internationally. Among its contributions are reference genomes for bovine, spruce, poplar, Atlantic salmon and Chardonnay grape; human reference epigenomes; and human, mouse and zebrafish cDNA reference transcriptomes. Its whole-genome analysis is being used to inform personalized treatment planning for cancer patients. The platform also provides training to technical and support staff, as well as graduate and postdoctoral research trainees.

With this Genome Canada funding, the platform will expand both its personnel and its service offerings, including both new technology development and assessment and data processing and bioinformatics analysis. It will also develop a bioinformatics virtual machine to provide researchers with the computational tools they need to interact with, visualize and analyze data. This funding will also enable the GSC to grow its capacity for genomics services through the collaborative partnership with University of British Columbia.

ALBERTA

The Metabolomics Innovation Centre

Platform leaders: David Wishart (University of Alberta), Christoph Borchers (University of Victoria)

Genome Centres: Genome Alberta; Genome British Columbia

Total funding: \$11.7 million

The Metabolomics Innovation Centre (TMIC) was launched in 2011 and serves as Canada's national metabolomics laboratory, mandated to provide Canadian scientists and trainees with access to comprehensive, cutting-edge metabolomics services and technologies. TMIC, which comprises seven nodes in four Canadian universities, has four key strengths: its ability to perform quantitative metabolomics on a wide range of matrices, including biofluids, tissues, plants, microbes, water, air and soil; its world-class informatics capabilities and database tools; its capacity to innovate and perform translational technology development; and its ability to perform metabolomic measurements and analyses for a wide range of health, agriculture, environment, wildlife, fishery and forest applications.

To date, TMIC has analyzed some 30,000 samples and conducted more than 55,000 assays, attracting more than \$3.6 million in service revenues from more than 285 Canadian and international academic clients, 33 government labs and 78 companies from Canada and around the world. It has leveraged Genome Canada's \$5 million in funding with an additional \$27.3 million in co-funding from other sources.

Moving forward, TMIC will grow substantially to meet an estimated tripling of metabolomics activities in Canada in the next five years. It will continue to extend its reach nationally and adding new technological capabilities. It will also expand its technology development activities, including developing and commercializing metabolomics kits to make metabolomics more accessible, affordable and mainstream.

ONTARIO

The Centre for Applied Genomics

Platform leaders: Stephen Scherer, Lisa Strug (The Hospital for Sick Children)

Genome Centre: Ontario Genomics

Total funding: \$11.6 million

The Centre for Applied Genomics (TCAG), founded in 1998, has been a Genome Canada Science and Technology Platform since 2001. TCAG provides genomics support and analysis to more than 800 Principal Investigator labs per year, a total of more than 2,000 over its lifetime, spanning 45 countries, 317 academic institutions, 150 companies and 46 government agencies and non-governmental organizations. Through its work, TCAG has catalyzed many significant scientific advances. TCAG developed and hosts the Database of Genomic Variants and the Ontario Population Genomics Platform repository, leads the “MSSNG” autism genome sequencing project and the Canadian Personal Genome Project, and is the Toronto node of Canada’s Genomics Enterprise (CGEn), a national network of whole genome sequencing centres.

With additional funding from Genome Canada, TCAG will continue to actively develop novel methodologies for whole genome sequencing, genome assembly and statistical analysis of genome-wide data. These activities will complement the development and implementation of additional pipelines and methods for generating and analyzing genomic data. TCAG will continue to work with national and international partners to advance the utilization of genomics to address many facets of multidisciplinary science, including a strong focus on human diseases and neurodevelopmental disorders.

The Centre for Phenogenomics

Platform leaders: Colin McKerlie, (The Hospital for Sick Children) Silvia Vidal (McGill University)

Genome Centre: Ontario Genomics, G nome Qu bec

Total funding: \$7.5 million

Discovering and understanding the function of genes and abnormalities in genes (“mutations”) that cause disease in children and adults remains a major challenge. Researchers use mouse models to evaluate the impact of these mutations, but need access to state-of-the-art services to enable their research. Since 2007, The Centre for Phenogenomics (TCP) has been providing these services, designing and producing customized mouse models, determining the functional consequences of genetic abnormalities, validating a phenotype (“observable characteristics that result from a mutation”) comparable to the human disorder, and investigating the underlying molecular pathways. It also supports translational services to reverse the effect of the mutations through genetic or pharmaceutical approaches. In the past five years, TCP has provided more than 40,000 services to 615 clients, generating nearly \$13 million in revenue. A Canada Foundation for Innovation review panel called TCP “the best facility of its kind in Canada and ... among the top five in the world.”

TCP brings together a unique Canadian critical mass of infrastructure, expertise, interaction and technology. Over the coming five years, it will expand its research services to infectious diseases and inflammatory conditions, both of which are common and major health and economic burdens to Canada. To support Canadian scientists' efforts to understand gene function and the genetic changes that cause disease, TCP will provide Canadian scientists with unparalleled access to leading-edge genomic services in disease model production and evaluation. TCP will also continue to develop new technologies and enhance existing ones to deliver state-of-the-art services, thereby maintaining its competitiveness and that of its users.

Network Biology Collaborative Centre

Platform leaders: Jeff Wrana, Anne-Claude Gingras (Lunenfeld-Tanenbaum Research Institute, Sinai Health System)

Genome Centre: Ontario Genomics

Total funding: \$6.7 million

The Network Biology Collaborative Centre (NBCC) at the Lunenfeld-Tanenbaum Research Institute was founded in 2014 to assist scientists with coupling the vast understanding of genomic and phenotypic variation in health and disease with a functional understanding of how gene products convey biological information and how their alterations drive disease.

The NBCC is built on one of Canada's first proteomics mass spectrometry facilities and one of the first academic screening centres, which date back to 1999. Since that time, the Centre and its precursors have provided critical support for high-impact research and the translation of that research into an understanding of disease mechanisms, increased economic activity and potential new treatments and improved health outcomes.

The NBCC currently operates through multiple complementary nodes: proteomics, high-throughput screening including next-generation sequencing, and high-content to high-resolution imaging. The NBCC provides not only its extensive expertise in the design and application of sophisticated screening strategies through these nodes, but also its ability to integrate these screens with each other to drive biological insights.

By continually innovating, improving and implementing new technology, NBCC continues to offer the highest-calibre services. Over the next five years, the Centre will extend its proteomics and functional genomics screening into more sophisticated systems that will better model health and disease states, and continue to integrate data management and analytics across all of its nodes. Through its work, it will help to ensure that future scientists remain internationally competitive and drive their science to realize the greatest benefits for Canada.

Canadian Data Integration Centre

Platform leaders: Philip Awadalla, Lincoln Stein, Vincent Ferretti, Jared Simpson, John Bartlett (Ontario Institute for Cancer Research)

Genome Centre: Ontario Genomics

Total funding: \$7.8 million

The Canadian Data Integration Centre (CDIC) is an international leader in genomics, bioinformatics and translational research, supporting some of the world's largest programs in genomic data analysis,

genomic and clinical data hosting, cancer data analyses and access and the development of algorithms for advanced sequencing technology. The CDIC's services range from small, bespoke data integration solutions to comprehensive large-scale genomic analyses and include the ability to handle difficult and small-volume biosamples, enabling investigators to maximize the utility of scant or rare clinical tissues. Its informatics and bio-computing core is the largest academic cancer informatics program in Canada and it is the only site in Canada to offer 3rd generation bioinformatics tools for researchers in genomics and functional and clinical genomics. In its first five years, CDIC has generated \$87 millions in grants and \$14 million in service revenue.

Over the next five years, CDIC will develop new technologies and methodologies for long-read sequencing, for research and clinical application; roll out translational biomarkers of therapeutics response and prognosis for clinical applications and services; and develop already-identified pan-cancer biomarkers for biopsy diagnoses to make them clinic- and industry-ready.

QUEBEC

McGill University and Génome Québec Innovation Centre

Platform leaders: Mark Lathrop, Tomi Pastinen, Ioannis Ragoussis, Guillaume Bourque (McGill University and Génome Québec Innovation Centre)

Genome Centre: Génome Québec

Total funding: \$12.6 million

The McGill University and Génome Québec Innovation Centre (MUGQIC) focuses on genomics applied to populations and its impact on chronic diseases, aging, cancer and genomic responses to environment. The Centre reflects key challenges in harnessing next-generation sequencing power into innovations in biomedicine, including study design; tools to assess functional differences in human tissue and cells; and techniques to assess functional genomic variation in populations.

MUGQIC supports some 900 academic and industry research teams from Canada and abroad each year, with revenues of \$71.5 million over the past five years. MUGQIC has a successful track record of providing the Canadian scientific community with access to high-throughput genomic facilities and state-of-the-art methodologies. Its extensive networking with national and international genomics communities enhances its ability to adopt new methodologies and ensure their deployment in cutting-edge scientific programs.

Over the coming five years, MUGQIC will extend its support to the scientific community through ongoing work on new technologies and methodologies. Among its unique features will be ethical, legal and social frameworks for research applications in human health; methods for population-wide interpretation of genomics data; and data-driven annotation of functional variation using in-house and public human population datasets. The Centre will also develop frameworks to use whole-genome sequencing as the primary tool for genetic analyses in humans and other species.

Centre for Advanced Proteomic and Chemogenomic Analyses

Platform leaders: Pierre Thibault, Michael Tyers (Université de Montréal)

Genome Centre: Génome Québec

Total funding: \$3.9 million

The Centre for Advanced Proteomic and Chemogenomic Analyses (CAPCA) provides leading-edge analyses to projects in cell biology, immunology, drug discovery and human health research. Since 2011, more than

270 research groups from academia, government and private laboratories in Canada and internationally have benefited from these services. Over the next five years, CAPCA will expand the breath of its services to include cutting-edge chemoproteomics and genome-scale analytical methods not currently available in Canada. In particular it will use new gene editing technology to implement a new chemogenomic service by directly assessing chemical/genetic interactions in human cells. CAPCA will bring value to the Canadian genomics network with leading-edge proteomic and chemogenomic analyses to meet unmet pressing needs in drug discovery programs.

Canadian Centre for Computational Genomics

Platform leaders: Guillaume Bourque (McGill University), Michael Brudno (The Hospital for Sick Children)

Genome Centres: Génome Québec, Ontario Genomics

Total funding: \$10.6 million

With next-generation sequencing and other high-throughput technologies, data production isn't the issue –it's the capacity to process and interpret that data that stands in the way of discovery and innovation. Bioinformatics services are expected to increase 21 per cent annually to nearly \$4.3 billion by 2020 and the Canadian Centre for Computational Genomics (C3G) will be part of that growth. C3G was launched in 2015 to provide informatics and analysis support to the life sciences community. Since 2011, the C3G team has completed 1,014 projects for 622 groups of researchers across Canada and internationally, with fee-for-service revenues of more than \$4.3 million.

C3G provides a unified national platform that relies on sharing expertise, technology and best practices. It provides genomics analysis across the life sciences; installs and distributes a bioinformatics software suite through Compute Canada; implements, deploys and distributes open-source software for the analysis of human and non-human data; and develops and supports a private cloud to support Private Health Information data analysis.

Over the next five years, C3G will expand its offering of analysis and informatics services to enable the implementation and distribution of novel tools in the areas of 'omics analysis, data integration, precision medicine for clinicians and maintaining the privacy of personal health information. Such services will help to realize the potential of genomics research and bring new insights to the different fields of the life sciences.