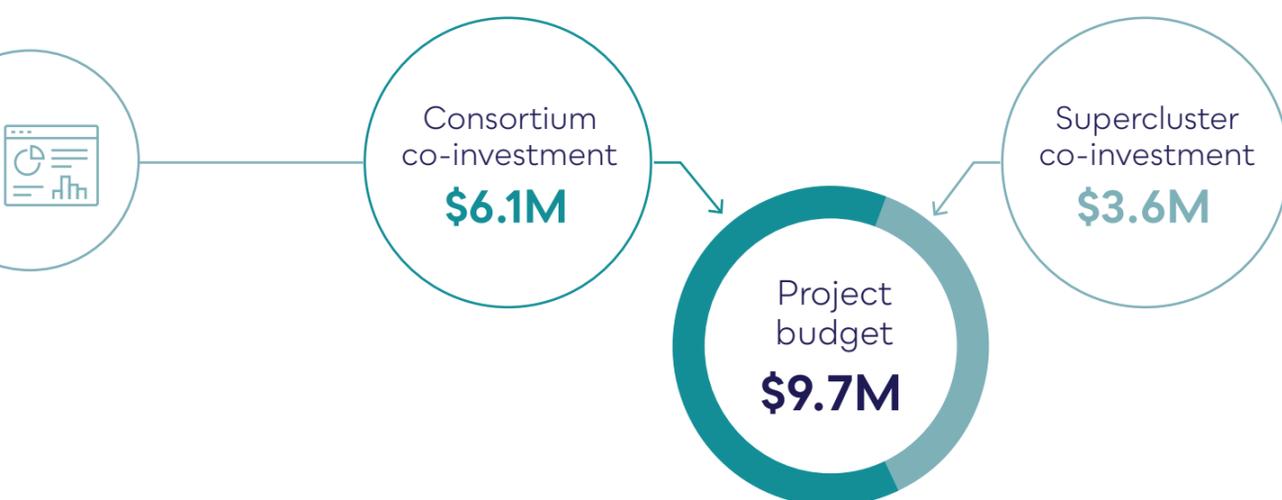




CANADA'S DIGITAL  
TECHNOLOGY  
SUPERCLUSTER

## Dermatology Point-of-Care Intelligent Network

AI-powered medical imaging network to connect all points of care for patients who may be dealing with skin cancer.



### Project Overview

One in six Canadians will develop some sort of skin cancer during their lifetime. Each year in Canada there are 80,000 reported cases of skin cancer (melanoma). The annual cost of skin cancer to the healthcare system is over \$500M coupled with immeasurable costs to families. Advanced cases of skin cancer can cost over \$160,000 per patient to treat, whereas a timely intervention can cost as little as \$50.



Canada is facing a severe shortage of dermatologists leading to wait times of six months or more to see one. Melanoma can rapidly progress in as little as six weeks and patient survival declines from 98% to 15% if treatment is delayed.

Change Healthcare is leading this research consortium which includes TELUS Health, MetaOptima Technology Inc., Careteam Technologies Inc., Providence Health Care and BC post-secondary research institutions to help speed diagnosis and expediate care for cancer patients.

The new cloud-based Dermatology Point-of-Care Intelligent Network will use MetaOptima's tele-dermatology and Change Healthcare's tele-pathology imaging, augmented by artificial intelligence. The project will also offer the possibility to not only expedite urgent cases faster through e-referral and e-triage but will train artificial intelligence (AI) models on real-life clinical data, to create algorithms for clinical decision support and medical education.

Change Healthcare's imaging division, with its decades of experience in radiology and cardiology imaging, will develop an enterprise-wide Intelligent Imaging Network (IIN) to manage multiple kinds of images and associated complex clinical workflows. MetaOptima will apply its revolutionary DermEngine platform to be used by medical professionals and integrated into TELUS Health electronic medical records and the patient-centered collaboration platform of Careteam Technologies. The project will apply the exceptional care backbone and integrated research expertise of Providence Health Care and the advanced research capabilities of a BC post-secondary research institution.

The project is expected to roll out in different regions of British Columbia in multiple phases in 2019 and 2020. Once proven to address the needs of British Columbians, the intent is to expand coverage of the system to other parts of Canada and the world, particularly those with increased solar exposure and higher incidences of skin cancer.

This project will also help the medical community accelerate early diagnosis of skin diseases and substantially improve skin cancer patient survivability by earlier diagnosis and intervention. Additionally, it will serve as a basis for building similar end-to-end processes in other image-intensive service lines such as Cardiology, Radiology, Pathology, Ophthalmology, etc.





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## Earth Data Store

A platform to aggregate and analyze geospatial and earth observation data.



## Project Overview

Canada's iconic landscape is defined by its resource rich forests, fields, lakes, mountains, and oceans.

Our resource sector contributes 17% to Canada's GDP. Improved stewardship and management is needed to protect Canada's forests from wildfires that cost \$0.5 - \$1.0 B annually and to support sustainable development of major resource projects valued at \$585 B over the next 10 years.



In Canada, and abroad, the remote sensing sector is poised for enormous growth because of the value of earth observation imagery. Global coverage and temporal resolutions of imagery data is increasing at an unprecedented rate, generating trillions of new pixels of imagery data daily.

The challenge with this ‘big data’ is finding practical ways to extract value and deliver it to end users at scale, both due to the complex nature and the sheer volume of information.

Detailed, standardized geographic information is required to enable analytics which facilitates good stewardship of our ecosystems by enabling insights to understand, monitor, and manage our environment and resources in sustainable manners. This can be accomplished through massive aggregation of data from remote sensors coupled with novel approaches to preparing and analyzing data.

UrtheCast, in collaboration with Sparkgeo, Microsoft, University of BC, University of Victoria, Bioenterprise and Geoscience BC, will address this challenge by developing the Earth Data Store, to provide unparalleled access to standardized temporal and spatial earth observation data and develop industry-specific applications that will allow end-users to see how a region evolves over time using visual interactive maps and running deep learning algorithms.

In this first phase, the Earth Data Store tackles the normalization problems of data, particularly with data generated from multiple sensors, which can consume up to 80% of the effort preparing for analysis. It is expected this project will support the growth of companies delivering big data/geospatial analytics products and information services, a global market estimated to be worth \$10 B.

The project will look at a number of use cases, including the assessment of risk related to climate change. Improved assessment of the impact of increasingly frequent “extreme weather” events can mitigate impacts on our resource sectors and the wellbeing of our citizens.





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## Forest Machine Connectivity

The collection and analysis of data using the Industrial Internet of Things technology to improve efficiency in the timber harvesting supply chain.

### Project Overview

In order to stay competitive in the global wood products manufacturing industry, Canfor and TimberWest recognized the need to digitally transform and modernize the timber harvesting supply chain to remain competitive in a global industry. The companies, in collaboration with Lim Geomatics, FPInnovations and UBC's Faculty of Forestry, are undertaking the Forest Machine Connectivity project to deliver the first and only application to solve the industry's technical barriers that impact efficiency.



The Forest Machine Connectivity project will use an Industrial Internet of Things (IIoT) platform, which is a network of 'smart' devices that can monitor, collect, exchange, analyze and deliver valuable insights. The insights and data delivered will allow contractors, machine operators and forest managers to identify bottlenecks and improve productivity in real time and develop best practices throughout the supply chain.

The project is subject to commercial terms and final approvals.

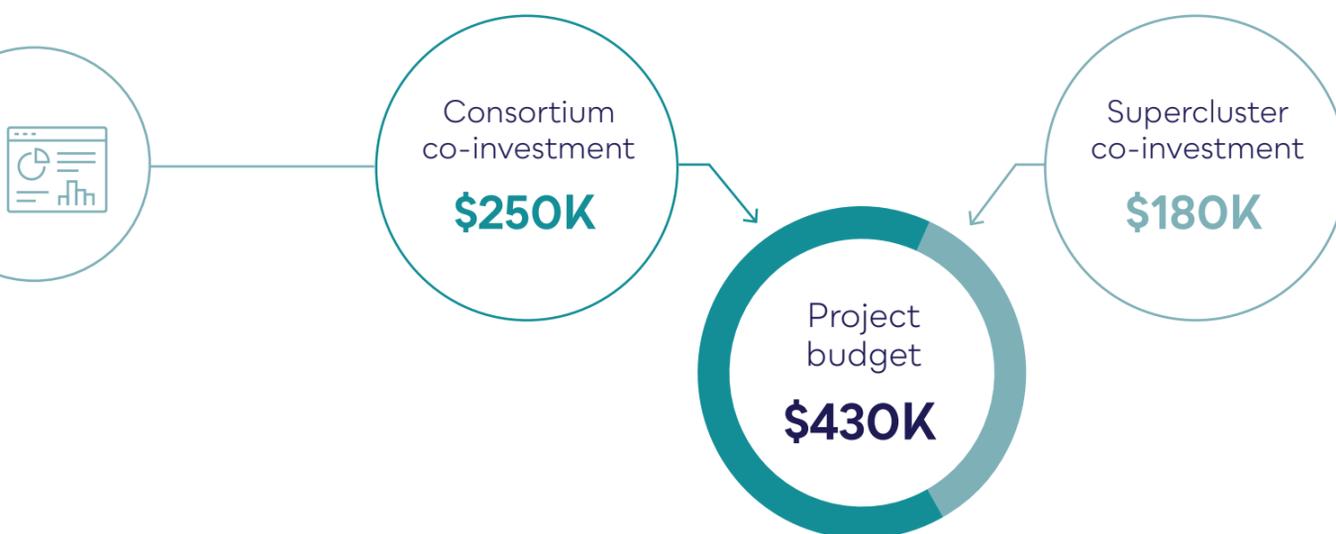




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# Predictive Analytics for Manufacturing Processes

The application of quantum computing to predict faults in the manufacturing process of advanced materials.



## Project Overview

Avcorp Industries provides the world's leading aircraft manufacturers with supply chain solutions and repair support. Yield optimization, predictive maintenance, and equipment calibration are needs that are widespread throughout the manufacturing industry.

Complex manufacturing enterprises are a large and growing market for Software as a Service (SaaS) solutions with predictive capabilities. The development of applicable, tailored SaaS systems will reduce costly factory downtime, improve product yields and bottom-line performance.

The root cause of failures in product testing is often difficult to determine, particularly when the failure signals are sparse relative to the available background data. Compounding the problem, the process must meet a variety of specifications for multiple customers simultaneously.



This project aims to create a digital twin of the metal finishing line to leverage predictive analytics to analyze data (chemical, temperature, voltage) captured from the process line and provide new insights for an optimized manufacturing process.

Led by D-Wave, the world's leading supplier of commercial quantum computing systems, software and services, this research partnership includes Avcorp Industries, Solid State AI, and Simon Fraser University (SFU). In addition to leveraging the research capabilities in data analytics at Simon Fraser University, Solid State AI will use its unique predictive analytics tools and advanced machine learning techniques on the D-Wave 2000Q™ quantum computer to address situations when failure signals are sparse, relative to the available background data. These tools will move Avcorp's manufacturing fault detection processes from reactive to predictive-based.

This project will demonstrate predictive capabilities that can also be deployed in other manufacturing processes, including a wide array of typical industrial manufacturing and semiconductor fabrication plants.

The estimated market potential for these types of products is approximately \$5B over the next 10 years. Some studies suggest that predictive maintenance can enable the world's manufacturing industry to save up to \$700B USD over the next two decades. Success in this program will position Canada as a new challenger in the global predictive analytics field.

The project will also be a proof-of-concept for the much larger Learning Factory project, a single digital twinning platform that will digitize and optimize multiple processes at Avcorp's manufacturing facilities. If successful, this pilot could lead to further projects between the project partners for future supercluster applications. Other Canadian manufacturing enterprises working with the Digital Technologies Supercluster are also potential customers for the analytics solution.

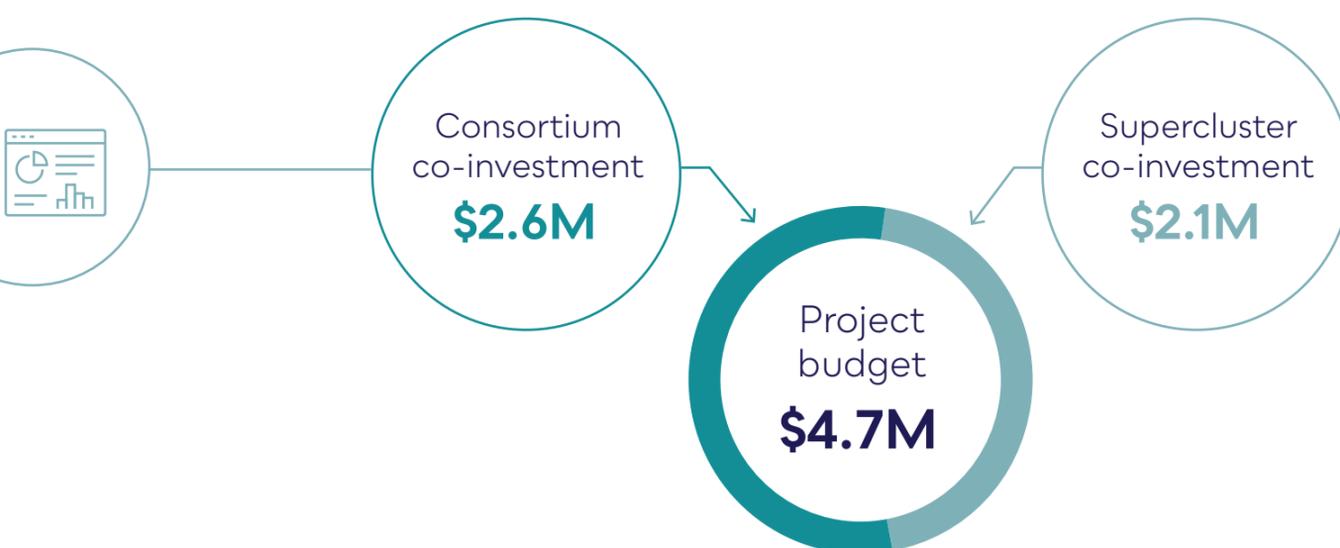




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## Tailored Health – Pharmacogenetics

An integrated approach to prescribing medication based on a patient's genetics.



### Project Overview

Pharmacogenetics (PGx) is the study of how genes affect a person's response to drugs. Inappropriate medication prescribing is associated with adverse drug reactions, hospital admissions and mortality which can all be reduced due to recent advances in genetic testing and translational technology.



Adverse reactions to medications account for up to 12% of emergency department visits, 5% of hospital admissions and are estimated to claim 10,000 to 22,000 lives per year in Canada alone.

This is exacerbated by the approximately 20% of Canadians that currently take three or more medications (polypharmacy). As the Canadian population ages the proportion of polypharmacy patients is expected to increase and cause additional stress on healthcare budgets.

Led by TELUS Health and in partnership with GenXys, LifeLabs, and Genome BC, the PGx project will create a pharmacogenetics ecosystem by digitally connecting testing labs and medication decision support software with primary care and pharmacy management systems. Enabled by a digitally-integrated solution, this PGx project will link two pharmacogenetic solutions combining an individual's genetic makeup with their biophysical, drug, and medical history, integrating clinically useful medication options into the clinical workflow through Electronic Medical Records (EMRs) and Pharmacy Management Systems (PMSs).

This project will enable estimating an individual's population-based drug risk, integrated pharmacogenetic testing, enhanced prescribing effectiveness, and the delivery of better health outcomes for Canadians. With patients and their clinicians using this solution, adverse drug reactions will be reduced, and the standard of care in Canada will be improved. The PGx project will help to realize the ultimate goal of providing "the right drug to the right person at the right time."

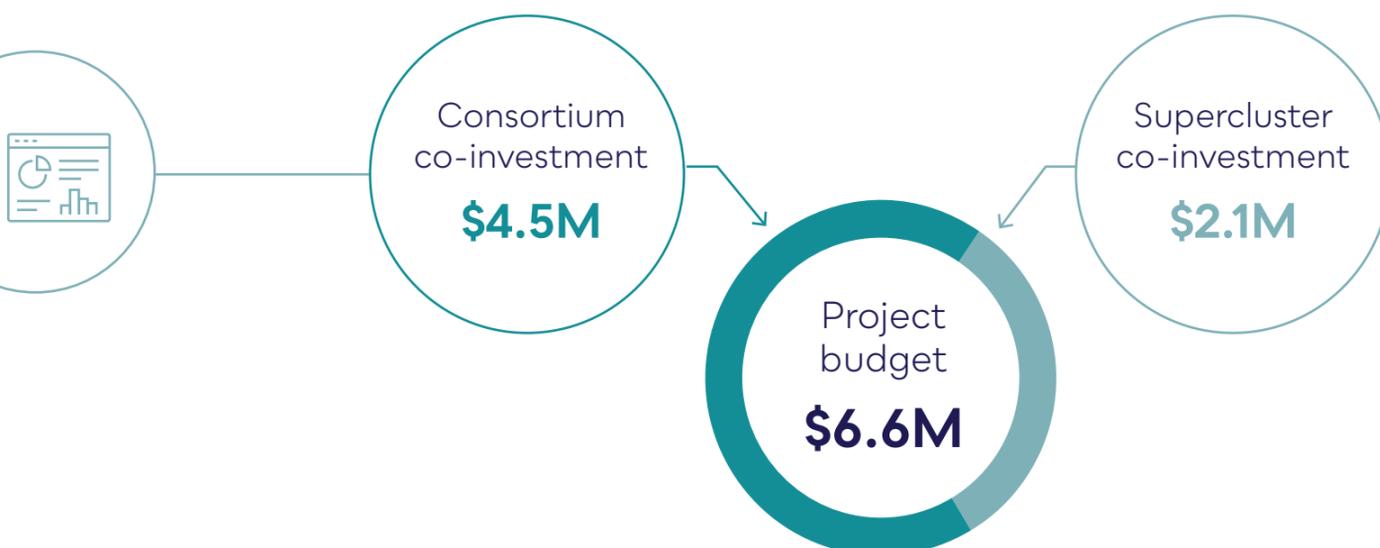




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## The Learning Factory Digital Twin

A proof-of-concept to apply digital twinning to the manufacturing process of aerospace components.



### Project Overview

Even the latest advancements in manufacturing processes and intelligent materials still rely on a form of trial and error: parts are produced and tested, and then refined and redeveloped in a costly, iterative process. The Learning Factory Digital Twin project will integrate advanced materials research with emerging manufacturing technologies to make products lighter, stronger, smarter, more durable and energy efficient, while minimizing production costs.

The simulation of traditional factory processes in a virtual environment will create, in essence, a digital twin of a physical production facility. Sensors will be deployed to collect real-time data that will be used in combination with physics-based simulations of the production line to detect problems faster, predict results more accurately, and ultimately lead to the manufacturing of better products.

The Learning Factory Digital Twin project will position British Columbia as a global leader in digitally enhanced advanced manufacturing, leveraging the Province's growing technology sector and existing relationships within the Cascadia corridor. British Columbia already plays a key role in the Canadian manufacturing industry with over 7,200 manufacturing establishments contributing \$14.7 billion to the BC economy (nearly seven percent of GDP) and nearly \$9B in exports in 2014, according to the Chartered Professional Accountants British Columbia Industry Update report on BC's Manufacturing Sector (Winter 2016).

Avcorp Industries Inc. will lead the project in partnership with Convergent Manufacturing Technologies Inc., AMPD, Boeing Research & Technology, LlamaZOO Interactive, and the University of British Columbia. Together, the project team will digitize segments of two existing industrial production lines for complex Boeing aircraft parts, bridging the knowledge and talent gaps between research, education and full-scale industrial production to create new, digitally driven industrial tools. These tools will have a dramatic impact on spatial planning, asset tracking, asset state determination, data collection, aggregation, physics-based simulation, digital architecture and process automation, benefiting diverse customer bases and industries.

The project will also demonstrate the mutual benefits of data-driven collaboration, enabling advanced computational and modelling approaches and commercial technology development opportunities. The project will inform, develop and evolve Technology Readiness Levels and Commercial Readiness Levels related to the project's key industrial digital technologies.



Lessons learned in this project will inform future work and create a new paradigm in advanced aerospace manufacturing. Hands-on learning and research will take place in parallel with a virtual environment enabling a cycle of innovation and continuous improvement through predictive maintenance, real-time monitoring and quality control.

Longer-term potential exists to construct a new Digital Learning Factory at the University of British Columbia's Okanagan campus in Kelowna, B.C., which would expand upon the learnings and new technologies developed during The Learning Factory Digital Twin project.



THE UNIVERSITY OF BRITISH COLUMBIA

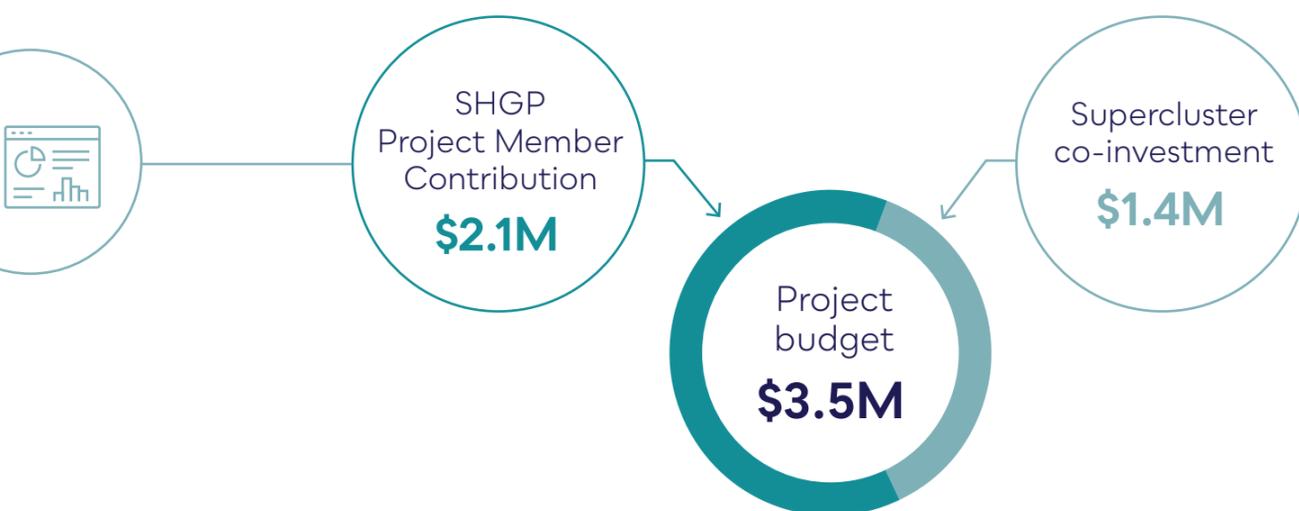




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# The Secure Health & Genomics Platform Program

An initial proof of concept to aggregate and integrate health and genomic data towards a pan-Canadian digital health platform through a world-class public trust model.



## Project Overview

Canada's moment to be a global leader in providing next generation, precision health care to its citizens is now.

Through Canada's Digital Technology Supercluster, innovators will take bold action in the \$8.7 trillion global health and biosciences marketplace to establish a Secure Health and Genomic Platform, positioning Canada as a global leader in precision health therapies.



Data aggregation and integration is the only way to advance the clinical implementation of genomic technologies and precision health. Currently, this data is siloed, with research and clinical data distributed in many local repositories across the country. There is no currently national platform for health and genomic data.

The Secure Health and Genomic Platform (SHGP) will be an integrated, secure, scalable, pan-Canadian solution for genomics and precision health. This digital platform will democratize access to secure storage, analysis, and sharing of genomics, clinical, and health information datasets to accelerate discoveries and the implementation of precision health innovation on a national basis.

The first phase of the SGHP is a proof of concept which will plan, design and build a prototype solution as a scalable, cost-effective, open, and interoperable system with a broad cross-section of stakeholders. The SHGP will build two unique areas where users will interact with unique bioinformatics tools to load, search and share through: 1) the Data Library and 2) Application Marketplace – both will be developed as a prototype for Phase 1.

Precision Health is one of the most promising applications of genomics and we are well-positioned to capitalize on it,” said Dr. Pascal Spothelfer, President & CEO at Genome BC. “There is unlimited potential when we bring together a strong, multi-disciplinary team and we are sure that Canadians will benefit from this ground-breaking work.”

“This project will accelerate the ability for Canadian innovators, researchers and health providers to work together to create innovative, more accessible precision health treatments for all Canadians,” said Marc Fiume, CEO of DNASTack.

The Secure Health and Genomic Platform leverages the Digital Supercluster ecosystem leaders in cloud computing, bioinformatics, data security, digital enablement, genome science, and health services and includes Microsoft, DNASTack, Genome BC, LifeLabs, Molecular You, Deloitte and the University of British Columbia (UBC), as well as the Provincial Health Services Authority as contributing advisors.

