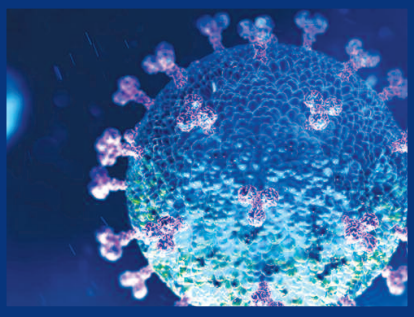
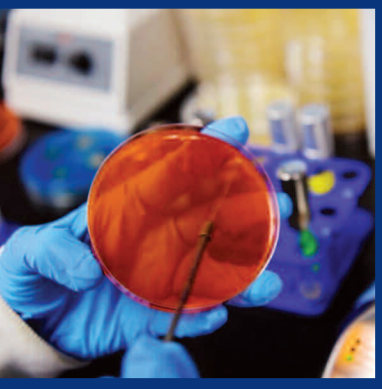
Annual Report

2020-2021

GenomeAtlantic





- ✓ Growing our Economy
- ✓ Adapting to Climate Change
- ✓ Protecting our Environment
- ✓ Promoting Health

Genomics comes of age in Atlantic Canada

As genomic technologies continue to rapidly evolve, DNA-based solutions are finding broader applications in our resource industries and in human health.

Genomics is supporting Atlantic Canada's ocean economy by driving innovations in aquaculture, offshore oil and gas exploration, and renewable bio-resources. Genomic technologies are improving production and sustainability of our forestry and agriculture industries and offering cleantech solutions for mining. We are using DNA-based tools to help our economy adapt to climate change and to monitor and protect our natural environment. And during the current COVID pandemic, genomics has been key to diagnostic testing and disease surveillance to help keep us safe.

Genome Atlantic is proud of our role in helping Atlantic Canada reap the economic and social benefits of genomic technologies. Since 2000, we have been instrumental in generating more than $139 million in applied R&D projects, all of which have directly benefitted our region.

Annual **Genome Atlantic**-enabled R&D investment has grown 3-fold from $4.3 million in FY2016 to $12.5 million in FY2021. This reflects Atlantic Canadian's growing interest in accessing the benefits of this powerful technology. Because **Genome Atlantic**'s focus is on end-users, an ever-increasing number of businesses look to us to find the research talent and partnerships that can help them action a new opportunity or overcome a specific challenge. Just as our project portfolio has grown, so too has private sector investment in our projects. In recent years, the Business Expenditure on R&D (BERD) as a percentage of our project portfolio has averaged 25 percent, compared to 8 percent in 2008.

Our success is in no small part thanks to our business development partnership with the Atlantic Canada Opportunities Agency (ACOA) and with Atlantic Canada's provincial governments. We are truly grateful for their continuing support, as well as for the core funding provided by the Government of Canada through Genome Canada. We also thank our many private and public sector partners for their commitment to investing in R&D. Their investment fosters innovation through new products, services and processes that help Atlantic Canada's economy grow and thrive.

Proven genomic technologies are making a big impact in Atlantic Canada, as you will see in our *2020-2021 Annual Report*, and they will play an even greater role in helping our region achieve post-COVID economic recovery. Genome Atlantic will continue to be a catalyst for innovative solutions that support our region's businesses, retool and strengthen our industries, and promote our health and well-being.

Mark Ploughman, PEng
Chair, Board of Directors

Steve Armstrong, PhD
President & CEO

Innovation where it counts

Genomics gives us a model for sustainable natural resources that embodies economic growth *and* environmental stewardship and that helps our resources adapt to a rapidly changing climate. Genomics is fueling innovations in human health care and playing a key role in our region's COVID diagnostic testing and disease surveillance. Genome Atlantic projects are delivering wide-ranging solutions in all these areas.

OCEANS

Dr. Stefanie Colombo, Dalhousie University Faculty of Agriculture, uses genomics to develop novel, plant-based feeds for aquaculture. *Credit: Truefaux Films*

- Selective broodstock programs are enabling a New Brunswick oyster grower to achieve a 60 percent increase in output and Prince Edward Island's mussel farmers the ability to double their yield within 10 years. Genomic tools are improving Newfoundland and Labrador's production of cleaner-fish used to combat sea lice infection in Atlantic salmon and are helping salmon farmers develop broodstock more resilient to warming ocean temperatures.
- In the offshore oil and gas industry, genomic analysis of microbes found on the ocean floor and in drill stems is helping the industry assess the presence of petroleum reserves in Nova Scotia's offshore, while microbes are also offering clues to prevent corrosion of offshore pipelines in Newfoundland and Labrador.

AGRICULTURE & AGRI-FOODS

- Genome Atlantic co-founded The National Apple Breeding Consortium to advance the science of apple breeding through innovative technologies like genomics which will enable local breeders to more quickly develop and commercialize apple varieties suited for growing in our region.
- Bacteria are becoming increasingly resistant to antibiotics, posing an enormous risk to the agri-food industry and the health of Canadians. Genomics is helping us understand which genes contribute to Antimicrobial Resistance and how they spread.

Dalhousie Faculty of Agriculture's Dr. Sean Myles (C), Dr. Zoë Miigicovsky (L) and Sophie Watts are using genomics to research and breed superior apples. *Credit: Truefaux Films*

FORESTRY

- Genome Atlantic was instrumental in establishing the Atlantic Tree Improvement Council (***AtlanTIC***), a pan-Atlantic provincial collaboration that supports and shares tree improvement innovations to benefit our forestry industry.

Forestry workers collect seed and pollen from spruce trees.
Photo: Nova Scotia Department of Lands and Forests

- Genomic tools are being used in New Brunswick to select superior performing spruce trees, projected to result in a 10 percent increase in commercial production.

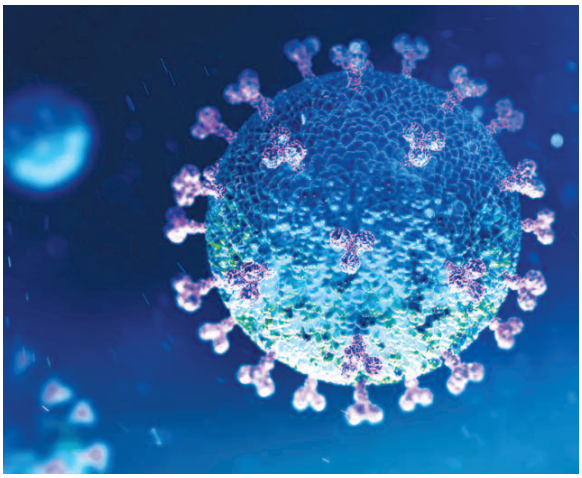
ENVIRONMENTAL STEWARDSHIP

- Environmental DNA (eDNA) is assessing the impact of industrial activity in Atlantic Canada's marine environments.

- Therapeutic feeds developed with the help of genomics have the potential to save the Canadian aquaculture industry many millions of dollars annually but also decrease the use of chemical treatments while minimizing the risk of transmitting pathogens to wild salmon.

HUMAN HEALTH

- Genome Atlantic has supported the development of new COVID surveillance and diagnostic tools and is part of a national program using genome sequencing to track the virus and its variants.



- Genome Atlantic has enabled research that is optimizing diagnosis and treatment of bipolar disorder.

- A Genome Atlantic project with the IWK Health Centre and Dalhousie University is using genome sequencing to achieve faster, more cost-effective diagnosis of suspected rare diseases in children.

By the numbers

IMPACT

Since 2000, **Genome Atlantic** has delivered

$139M More than **$139 million** in applied genomics **R&D**

2,055 Representing **2,055 person years** of **employment**

INVESTMENT

Private Sector Investment in Genome Atlantic's Portfolio

25% Business Expenditure on R&D (BERD) averages **25 percent** (compared to 8 percent in 2008)

Includes **both** small-to-medium-sized enterprises (SMEs) & large private sector companies

ACTIVE PROJECTS

Current **Active Projects** Portfolio

$56M Total value **$56 million** (as of March 31, 2021)

23/4 Encompassing **23 projects** across **four Atlantic provinces**

25+ 15+ In partnership with **25+ companies** and **15+ universities**

GENOME ATLANTIC

Genome Atlantic is a not-for-profit organization and part of the **Genome Canada** Enterprise.

*We work with private and public sector partners to deliver applied R&D projects across Atlantic Canada. **Genome Atlantic**'s work spans natural resource sectors, environmental stewardship and human health.*

2020-2021 Highlights

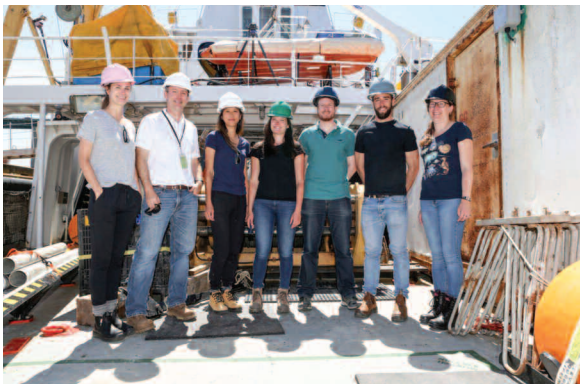
April 2020 – Genome Atlantic launches COVID-19 Regional Rapid Response program for Atlantic Canada, with $250,000 in funds to address short term needs to help the region better respond to the pandemic.

June 2020 – Genome Atlantic announces $300,000 in COVID research funding for scientists pursuing innovative approaches to predicting disease severity and surveillance testing.

October 2020 – Genome Canada announces a three-year, $4.8 million Genome Atlantic-led and managed research project to speed up the diagnosis of rare diseases in children.

November 2020 – Genome Atlantic announces $800,000 initiative to help protect Prince Edward Island's blue mussel industry from climate change, with the aim of doubling the industry's production and economic impact within 10 years.

December 2020 – Initial findings from a $6.5 million offshore oil and gas R&D project co-led by Genome Atlantic and Genome Alberta confirm the presence of microbes in hydrocarbon seeps in the Scotian Shelf off Nova Scotia. The findings are published in *Nature Communications*.



A research team from the N.S. Department of Energy & Mines and the University of Calgary embark on an offshore oil and gas coring cruise. Researchers from Saint Mary's University are also involved in the core sample analysis.

February 2021 – Nova Scotia's Forestry Innovation Trust invests $315,500 over four years in Genome Atlantic to support the Atlantic Tree Improvement Council (AtlanTIC) in producing more resilient, commercially important tree species.

March 2021 – Genome Canada announces a $4.7 million project, co-led by Genome Atlantic and Genome BC, to tackle complex gill health disease, a growing health challenge for salmon farming operations.

Delivering impact, building sustainability

This has been a busy year for Genome Atlantic with many new projects coming onstream to add to an already bustling portfolio. Here is a cross-section of some new initiatives:

Wastewater surveillance acts as COVID early warning system

Wastewater testing for Covid-19.

A Genome Atlantic-funded pilot project with Dalhousie University researchers demonstrated that wastewater surveillance is an effective tool for detecting COVID-19 in municipal wastewater systems. The pilot gave rise to a broader project funded by Research Nova Scotia with more than 15 wastewater sampling sites around Nova Scotia. Wastewater sampling gives Public Health officials advance warning of viral outbreaks so they can take mitigating measures.

Fighting climate change with genomics-based tree improvement

Genome Atlantic was instrumental in founding the Atlantic Tree Improvement Council (AtlanTIC) and provided support for the development of AtlanTIC's $6 million, five-year tree improvement plan to create long-term sustainability for the region's commercial woodlands. With genomics set to play a leading role, AtlanTIC will facilitate and coordinate the region's tree improvement breeding programs, which will include breeding commercial tree species that can flourish in our changing climate. In February 2021, Nova Scotia's Forestry Innovation Trust invested $315,500 over four years through Genome Atlantic to support of AtlanTIC initiatives in Nova Scotia.

J.D. Irving Ltd. used genomic data to select the poorest growing parents of white spruce trees and removed them from their orchard. *Photo: Greg Adams*

AtlanTIC Membership: *Genome Atlantic; J.D. Irving Limited; Northern Pulp; Port Hawkesbury Paper; Canadian Forestry Service; Natural Resources Canada; Nova Scotia Department of Lands and Forestry; Newfoundland and Labrador Department of Fisheries, Forestry and Agriculture; New Brunswick Department of Natural Resources and Crown Lands; Prince Edward Island Department of Agriculture, Natural Resources and Industry*

Atlantic gill health project tackles problem for salmon farmers

Complex Gill Disease is a growing problem for salmon farming operations on Canada's east and west coasts. A $4.7 million project co-led by Genome Atlantic and Genome BC will create genomic tools for developing an early warning system and for guiding management and intervention strategies for complex gill disease in Atlantic salmon.

Collaborators: *Genome Atlantic, Genome Canada, Genome BC, Cermaq Canada, Grieg Seafood, Cargill, Fisheries and Oceans Canada, University of Prince Edward Island, Mitacs Canada, Memorial University, and the BC Salmon Farmers Association*

Childhood rare disease project aims to cut diagnostic wait times

A research collaboration between Genome Atlantic, Dalhousie University and IWK Health aims to speed up diagnosis of rare diseases in children. The $4.8 million, three-year project, managed by Genome Atlantic and funded through Genome Canada's All for One precision health initiative, will use genetic (DNA) sequencing data to achieve faster and more cost-effective diagnosis of suspected rare disease in children at the embryonic, fetal and prenatal stages of development.

Dr. Karen Bedard, Dalhousie University, is co-leading a project aimed at speeding diagnosis of rare genetic disorders in children. *Credit: Nadia Zheng Photography*

Collaborators: *Genome Atlantic, Genome Canada, Dalhousie University, IWK Health, Research Nova Scotia, Dalhousie Medical Research Foundation*

Getting cleaner-fish ready for prime time

Dr. Javier Santander (L) and Danny Boyce, Memorial University, are using genomics to speed up selective breeding of cleaner fish. *Credit: Truefaux Films*

Sea lice are a big problem for Canada's Atlantic salmon producers and cleaner fish offer a natural solution. Genome Atlantic is partnering with Cold Ocean Salmon and scientists at Memorial University on an $840,000 R&D project to sequence the genome of Lumpfish and Cunner in order to speed up selective breeding.

Collaborators: *Genome Atlantic, Genome Canada, Government of Newfoundland and Labrador, Atlantic Canada Opportunities Agency, Memorial University, Cold Ocean Salmon, (a division of Cooke Aquaculture)*

Climate-proofing Blue Mussels

An $800,000 Genome Atlantic project aims to protect Prince Edward Island's valuable Blue Mussel industry from the impacts of climate change. The initiative is predicted to double mussel production along with the industry's economic impact within 10 years . It currently accounts for $60 million in direct economic growth, employs 1,500 Islanders and pays $11 million in salaries.

Hauling up socks of P.E.I. mussels. *Credit: Truefaux Films*

Collaborators: *Genome Atlantic, Genome Canada, Atlantic Fisheries Fund, Government of Prince Edward Island, Atlantic Aqua Farms, Prince Edward Island Mussel Farms, Prince Edward Aqua Farms, PEI Marine Science Organization*

Environmental genomics tools for N.L.'s oil and gas industry

Oil rig off Newfoundland and Labrador

The offshore oil and gas industry must operate within strict environmental stewardship practices and yet environmental assessments can take up to five years or more, representing a barrier to growth and development.

Genome Atlantic is partnering with Petroleum Research Newfoundland and Labrador (PRNL), eDNAtec, and Fisheries and Oceans Canada on a $1.3 million R&D project aimed at tailoring environmental DNA (eDNA) for use in the ocean environment and comparing this approach to traditional biomonitoring techniques.

Collaborators: *Genome Atlantic, Genome Canada, PRNL, eDNAtec, Fisheries and Oceans Canada*

Regional genomics projects get funding for COVID-19

Dalhousie University scientists received more than $300,000 in funding from Genome Canada's COVID-19 Regional Genomics Initiative and Research Nova Scotia for genomics research into critical areas in the battle against COVID-19.

One team is pursuing biomarkers for COVID-19 that could predict disease severity while a second team is piloting an innovative protocol for large-scale surveillance testing.

Collaborators: *Genome Atlantic, Genome Canada, Dalhousie University, Research Nova Scotia*

Technology Spotlight:

Genomics and Climate Change

The same genomic tools that help resource industries improve productivity and sustainability are proving equally valuable in helping those industries mitigate and adapt to changes in climate.

Genomic selective breeding accelerates traditional breeding in crops, aquaculture species and commercially grown trees, and selects for characteristics that are more resilient in a changing climate.

Genomic environmental technologies like environmental DNA (eDNA) are helping us to monitor biodiversity in relation to seasonal shifts, as well as the impacts of industrial developments on the natural environment.

Genomics is also being used to **reduce greenhouse gas emissions** from waste and agriculture, including through bacterial engineering projects such as waste diversion from landfill sites, development of more efficient livestock and fish feeds, and reduction of nitrous oxide emissions from soil.

Our People

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Financial Statements available on our website.
Documents available in French upon request.

GenomeAtlantic

Helping Atlantic Canada grow and thrive through genomics

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