Innovate UK

Innovate UK Global Expert Mission Report

Engineering Biology in Canada

September 2025

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Ontario Genomics Workshop

Discussions on Agri-food applications for EngBio technologies

01. Executive Summary

Globally, engineering biology is recognised as a critical technology for economic growth, sustainability and food security, with applications in key sectors driving innovation in the UK. One of the Frontier Technologies as part of the UK's Modern Industrial Strategy[1], and a sector of large investment throughout the UK, engineering biology is a rapidly evolving field with strong opportunities for international collaboration.

The Canadian ecosystem has developed potential for the UK to collaborate and drive innovation in engineering biology, and scale-up applications. Driven by the nation's focus and commitment towards sustainable and circular solutions, their universities, industries and public bodies are well aligned for bilateral collaboration.

In line with these efforts, in 2025 the UK and Canada signed a Memorandum of Understanding (MOU)[2] focused on science, technology and innovation. Building on previous bi-lateral co-operative commitments and funding partnerships, this MOU focused on increasing efforts between the two countries to develop cutting-edge research and bring innovative solutions to market. Driving the collaboration of expertise around standards, governance and regulation within the growing engineering biology sector is also at the heart of the MOU's commitment.

This Global Expert Mission (GEM) forms part of this ongoing collaborative agreement and was focused on understanding the potential opportunity for Canada and the UK to collaborate to apply engineering biology technologies to address challenges across application areas and to drive economic growth. The areas of focus for the GEM were: agri-food (novel food products and crop protection alternatives); clean technology (alternatives to petrochemical feedstocks for material and fuels); and environmental solutions (using microbes for plastic contamination and critical mineral recovery in mining and water).

The GEM found a Canadian ecosystem very receptive to expanding on collaboration with the UK, and actively engaged in the idea of using each country's own expertise in the space for mutual and wider benefit. Through a combination of internationally renowned universities, federal and provincial support mechanisms, and private companies and networks, the Canadian engineering biology sector is well placed to continue its growth.

1 The UK's Modern Industrial Strategy | Department for Business and Trade
2 Dual memorandums of understanding cement Canada–UK science and innovation ties | Government of Canada

GEM Delegation touring Saskatchewan Food Industry Development Centre

As a result, there are many opportunities for UK counterparts. From researchers developing novel scientific breakthroughs, to start ups and SMEs wanting to demonstrate and scale their innovations, working more closely with Canadian stakeholders would bring real benefits to accelerating and broadening the development of novel engineering biology solutions. The GEM identified bilateral opportunities with new scale-up facilities in Saskatchewan, novel science in Quebec, and research and ecosystem support in Ontario among many other opportunities – with evidence of further infrastructure and insights across the country beyond the extent of this mission alone.

There are, naturally, some hurdles to overcome in the pursuit of efficient and effective progress. A misalignment in the terminology and interpretation of engineering biology between the two countries could initially hinder the creation of agreed standards and regulation, while also making partnership building potentially more challenging for finding appropriate collaborators with matching ambitions and capabilities. The mix of the federal and provincial support landscape in Canada could also create some complexity in forming funding agreements and nationally aligned objectives.

It is, however, important to build on the enthusiasm and opportunity seen throughout the GEM with future sector engagement. Waste, by-product and critical mineral recovery, re-use and valorisation was seen throughout the mission as a crucial area for exploration using Canada's natural resources, while regulatory engagement and collaborative ecosystem building for founders and researchers has been seen to be critical to the long-term development of the sector both nationally and globally.

Work is required to consider the application of new research techniques and technologies in each other's market, while mapping the landscapes and capabilities in both the UK and Canada can bring understanding of where mutual benefit and opportunities lie. There is also real value in further exploratory in-person bilateral missions, as well as in joint-funding initiatives to drive new research and innovation partnerships to support the opportunities that engineering biology solutions offer to a variety of problems across the key application areas.

02. Acronyms

The following are common acronyms used throughout this report:

B2B	Business to Business
B2C	Business to Consumer
DBT	Department for Business and Trade
DSIT	Department for Science, Innovation and Technology
FCDO	Foreign, Commonwealth and Development Office
GBIP	Global Business Innovation Programme
GEM	Global Expert Mission
GIP	Global Incubator Programme
IUK	Innovate UK
STN	Science and Technology Network
TMF	Technology Missions Fund
UKRI	UK Research and Innovation

03. Introduction

Innovate UK, Innovate UK Business Connect and the Global Expert Missions

Innovate UK, part of UK Research and Innovation, is the UK's innovation agency. Innovate UK supports business-led innovation in all sectors, technologies, UK regions and globally. It helps businesses grow through the development and commercialisation of new products, processes, and services, supported by an outstanding innovation ecosystem that is agile, inclusive and easy to navigate.

As innovation is increasingly a global endeavour and more UK businesses have the ambition to grow and scale globally, it is important to create the right opportunities on which businesses can capitalise. Innovate UK's Global Expert Missions (GEM) programme draws on the expertise of the UK business community to better understand the opportunities in specific countries, technology and sector areas. Delivered by Innovate UK Business Connect, the GEMs provide the evidence base for where Innovate UK (and wider UK Government) should commit resources to enable opportunities for UK businesses to build partnerships and collaborations with key economies. Built around UK business, policy and research representation, a GEM's objectives are:

1. Building International Collaborations
The expert insights will help inform how Innovate UK can best help UK innovators and businesses find and exploit opportunities for innovation partnerships that bring mutual benefits and help drive the long-term success of the sector. The GEM creates connections with key organisations and people that will deepen and widen the collaboration with the partner country to the benefit of researchers, innovators and companies from both nations.

2. Informing UK Businesses and Government
The mission findings and expert insights resulting from the GEM are made available to UK businesses and Government departments. These inform UK businesses and the Government about potential opportunities for innovation in a country of interest and how it can help UK businesses make the most of those opportunities.

3. Sharing UK Capabilities
During the Mission visit, the delegation of experts will use the opportunity to share the UK's innovation strengths and identify where there are synergies between the two countries that can help inform and benefit the Canadian stakeholders hosting the delegation during the GEM.

Mission Overview and Objectives

Engineering Biology is an innovating sector with application across key sectors for economic growth and sustainability. It is recognised as one of the UK Government's key priorities as part of the UK's Modern Industrial Strategy and is detailed within the Digital and Technologies Sector Plan as an area for continued UK Government investment as a frontier technology.[3] Engineering biology investments through the UKRI Technology Missions Fund (TMF) is already supporting a wide portfolio of projects that involve both university and industry partners.

This GEM to Canada took six UK experts in engineering biology to visit key stakeholders from across academia, research, business and public agencies, to identify collaboration opportunities between the two countries in this sector for mutual benefit. The findings are disseminated publicly through this report, and key recommendations will be taken forward by Innovate UK and shared with relevant UK Government departments and organisations. The visit aimed to explore shared priorities across the UK and Canadian ecosystems, innovation landscape and complementary capabilities within engineering biology and where engineering biology solutions could be applied to challenges being faced across the agri-food, cleantech and environmental sectors.

UK activities

To help unlock the potential of engineering biology to address key societal challenges, UKRI invested £70 million between 2023 and 2025 through the TMF. Innovate UK funding through the TMF programme included a successful Accelerator programme – with two rounds running since 2023 that have supported 40 founder-led companies – as well as 20 Feasibility grants to SMEs and 48 Collaborative R&D grants to support business-led innovation focused on food systems, biomedicine, clean growth and environmental solutions.

Themes

The GEM to Canada was focused on exploring the opportunities of collaboration and where UK innovations in engineering biology could be applied to industry-relevant problems across a range of application areas, building out from the investments and capacity developed through TMF investments. The GEM therefore focused on key thematic areas to help focus and direct meetings with various Canadian stakeholders.

The following technical areas were within scope:

- **Agri-food** (e.g., precision breeding, novel modality biologicals to displace traditional crop protection products, alternative proteins).
- **Cleantech** (e.g., bio-renewables as alternative to oil-based for aviation fuels, platform and speciality chemicals).
- **Environmental solutions** (e.g., microbes to breakdown plastic contamination, more efficient wastewater and sewage treatment, new extraction and recovery technologies for mining of critical minerals).

Objectives

The objectives of the Mission were to:

- Gain an understanding of the engineering biology landscape in Canada, including related challenges and opportunities around agri-food, cleantech and environmental solutions.
- Share an overview of the UK's landscape to stakeholders in Canada, to highlight opportunities to collaborate.
- Understand the Canadian market dynamics and trends in engineering biology, as well as priorities of the Canadian Government to identify synergies with those of Innovate UK.
- Identify potential collaborators or partner organisations also seeking to invest in and support the development of the engineering biology sector.
- Explore key geographical hubs for innovation and potential locations for future activities for mutual benefit.

3 Digital and Technologies Sector Plan | GOV.UK

04. Sector Overview

The Global Engineering Biology Landscape

In 2023, the global synthetic biology market was worth US $16.5 billion, with the potential to reach $96.4 billion by 2033, directly underpinning the engineering biology (Eng Bio) sector.[4] As regulatory, scientific and commercial challenges are overcome, Eng Bio has the potential to generate between $0.8tn and $1.2tn annually, and generate up to 60% of the world's physical inputs.[5]

Whilst historically dominated by healthcare, novel solutions in agriculture, aquaculture, cleantech and environmental solutions are a growing revenue source. Novel material manufacture, fermentation process improvements, and chemical processing could provide a further $200bn to $300bn in terms of direct annual impact.

Although North America has remained the largest market to date, with around 42% market share in 2024, the Asia Pacific market is the fastest growing - thanks to significant investment from government and private companies. Europe continues to be a strong region too, with the UK, France and Germany all benefiting from innovation-driven landscapes, collaboration among stakeholders, and government support for infrastructure development.[6]

4 Synthetic Biology Market Size | Market.US
5 The Bio Revolution: Innovations transforming economies, societies, and our lives | McKinsey
6 Synthetic Biology Market Size & Outlook, 2025-2030 | Grand View Horizon

The Canadian Market

The Canadian EngBio sector is no different, expected to grow significantly in the next decade - with an overall market value of US $1.3bn by 2030 and a CAGR of 18.3% between 2025-2030.[7] These figures make Canada the fastest growing regional market in North America, as it looks to cement its development as a major player in the EngBio space and grow beyond its 2024 global market share of 3%.[8]

Historically, Canada has excelled in bio manufacturing and advanced therapies, which has supported developments by industry and policy towards food technology and implementations to improve sustainability targets.

Canada has a strong early-stage ecosystem that combines leading university-led research with start-up proof-of-concept testing and initial scaling. The focus now is moving towards supporting next-stage development in building size and capacity, while also addressing the need for effective and informed founders and support networks as the sector develops further.

What's Driving Innovation?

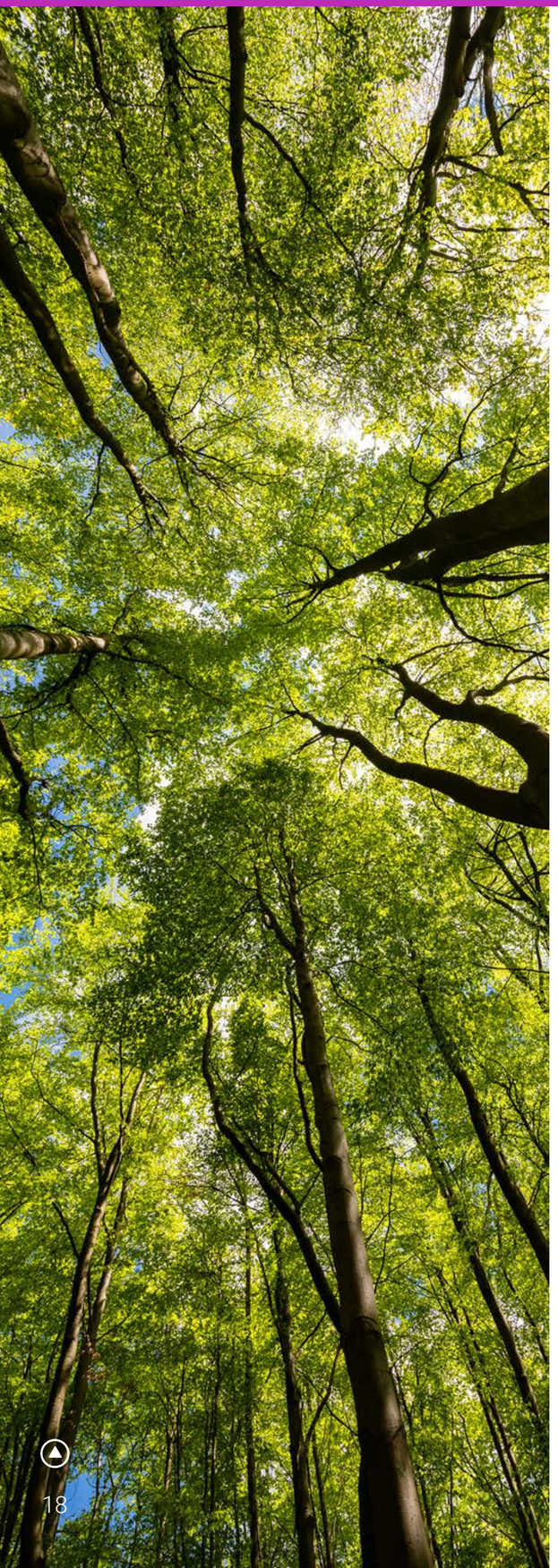
Environmental impact and sustainability remain key drivers to the growth of the EngBio sector, as companies focus on novel ways to optimise resources and processes in a way that will improve their environmental impact while delivering economic results.

In the food sector, novel solutions are driven by the need to tackle issues around food security, climate change and land use, as well as improving the sustainability and efficiency of modern food production methods. Advancements to engineering methods in plant biology are building crop resilience and health metrics, while also supporting the public demand for more circular solutions to waste and by-products.

The need for alternatives to traditional fuels, chemicals and materials – especially where petrochemicals are still key components – is an overarching driver for EngBio support in many countries. Reducing reliance on fossil fuels remains a global concern, leading to research and support for methods to create alternative biofuels, such as ethanol and biodiesel, as well as renewable energy opportunities.

Critical mineral and metal recovery is another priority area where EngBio concepts have reacted to global demand. Novel techniques and research into recovery from waste streams are developing at pace in response to requests from government and industry for new solutions to tackle resource limitations in key areas.

7 Canada Synthetic Biology Market Size & Outlook, 2025-2030 | Grand View Horizon
8 Ibid.



The Canadian Response

Canadian Genomics Strategy

In 2025, the Canadian Genomic Strategy[9] was announced by the Government to strengthen the connection between early-stage research and commercial market opportunities, as well as supporting the scaling of successful Canadian firms in this space.

The strategy focuses on the use of genomics technology in precision health, energy and sustainable materials. It aims to strengthen the sector by advancing commercialisation, increase data accessibility and developing talent to drive adoption and development of EngBio in the country. The strategy highlights a number of challenges that need to be addressed to drive adoption of EngBio in Canada, which include i) investment and intensifying R&D activities, ii) coordination across Canada's fragmented genomics ecosystem, and iii) addressing significant labour shortages in the bioeconomy.

Building upon the previous commitment of CAN $1.6 billion in the past 20 years, the Government of Canada's aim it to maintain Canada's leading position in the sector as new technologies and innovations advance and mature – changing the fast-moving landscape. This strategy commits to fund a further CAN $175.1 million over seven years, starting from 2024-25, to help drive research to real-world application.

In addition to human health aims, the strategy focuses on EngBio in wider operations, including:

- **Agriculture and agri-food** genomics developments, such as improving crops and livestock practices to be able to weather the effects of climate change.
- **Forestry genomics**, including improved forest productivity and conservation through a better understanding of the genetic variation of species.
- **Fisheries and aquaculture genomics**, including the study of finfish and shellfish genomes to enhance breeding and farm conditions.
- **Environmental stewardship**, including the use of genomics tools to map biodiversity, improve an ecosystem's resistance to climate change, and develop new nature-based solutions to reduce emissions.
- **Energy**, where genomics can lead to innovations in fuel production and the cultivation of renewable resources.
- **Mining**, where genomics can help mitigate the environmental impact of projects and genetically enhanced microorganisms can assist in the non-toxic bioaccumulation of critical minerals.

9 Canadian Genomics Strategy | Government of Canada

Ontario Genomics Roadmap

A 2020 white paper by Ontario Genomics outlined the actions taken to develop a roadmap approach to EngBio efforts, offering a coordinated effort to addressing key challenges and identifying priority areas where the greatest impact can be seen.[10] Within these efforts, the establishment of the Canadian DNA Engineering Systems Network (Can-DESyNe) has been a key development which brings together key stakeholders on priority areas, including: [11]

1. **Low carbon manufacturing:** Use of EngBio in industrial biotechnology to rejuvenate the green economy and reduce GHG emissions and waste. Here, technology is to focus on circular bioeconomy for biomaterials and minerals.
2. **Food security:** Strengthening leadership in plant-based and alternative proteins through EngBio, with a focus on protein bio manufacturing.
3. **Advanced health technologies:** Expanding Canada's bio manufacturing capabilities in advanced diagnostics, vaccines and biologics.

The activity undertaken throughout this GEM focused on the development of collaboration and opportunities connected with the first two of these priorities.

10 Genomics on the Frontlines 2020-2021 Annual Report | Ontario Genomics
11 Engineering Biology: A platform technology to fuel multi-sector economic recovery and modernize bio manufacturing in Canada | Ontario Genomics

05. The Innovation Landscape

Innovation Support

With far reaching opportunities for further innovation and commercialisation of EngBio technologies, innovation support in Canada is multifaceted, with federal and provincial public agencies, and private organisations supporting this space.

Federal Landscape

Innovation, Science and Economic Development Canada (ISED)
ISED is the federal institution in Canada responsible for supporting science and innovation as well as key sectors and technologies. It works in all areas of the economy and in all parts of the country to improve conditions for investment, enhance Canada's innovation performance, increase Canada's share of global trade and build a fair, efficient and competitive marketplace. It is responsible for the Canadian Genomic Strategy and the development of the sector.

National Research Council (NRC)
Within the federal and provincial landscape, the NRC is Canada's predominant R&D organisation, supporting research, innovation and commercialisation through facilities, grants and challenge programmes bringing novel solutions from lab to market.

One key component of NRC's activity is their Industry Research Assistance Program (IRAP).[12] IRAP's mission is to accelerate the growth of SMEs across Canada through innovation and collaboration and mentoring and advisory services, they are also influential in creating international collaboration, consortiums and bilateral innovation.

12 About the NRC Industrial Research Assistance Program | National Research Council Canada

Protein Industries Canada
Protein Industries Canada is an industry-led, not-for-profit organisation created to position Canada as a global source of high-quality plant protein and plant-based co-products. The organisation is one of Canada's five Global Innovation Clusters[13].

Protein Industries Canada works with private sector industry partners to create co-investment projects that have the potential to transform the agriculture and food production sector, allowing Canada to secure its position as a global leader in the production of plant-based products and co-products.

Protein Industries Canada will work with companies to gain pathways to customers, markets and partnerships that they could not access on their own, thereby providing them with the opportunity to leverage their expertise and innovations with that of large and multinational enterprises, public sector organisations and academia.

The Sustainable Canadian Agriculture Program (Sustainable CAP)
Sustainable CAP[14] is a CAN $3.5-billion support mechanism aimed at strengthening the resilience and competitiveness of the agri-food and agri-based products sectors in Canada. The aims are to support research and innovation in science to address challenges, seize opportunities, open doors to new markets and improve the Canadian sector's own strength.

Genome Canada
Genome Canada[15] is a federally funded, not-for-profit organisation aiming to help shape and impact the national genomics sector in Canada. Through funding, networking and policy engagement, Genome Canada are a leading voice for the industry and its priorities at national and regional levels.

Beneath the national operation, Genome Canada also oversees a network of six independent regional genome centres. The aim of this model is to maximise the impact of innovation by aligning it to regional strengths and requirements, and to leverage investment from provincial governments, industry and academia to create and deliver more effective research partnerships.

13 Global Innovation Clusters | Government of Canada
14 Sustainable Canadian Agricultural Partnership | Government of Canada
15 Homepage | GenomeCanada

Provincial research landscape

Given Canada's provincial landscape and funding system, some further opportunities for support in the EngBio sector can be found through provincial organisations.

Fonds de Recherche du Québec[16] are an important part of the research landscape in the province, providing comprehensive multi-agency support to researchers across the natural sciences, technology and engineering, health sciences, social sciences and humanities.

Across other provinces, similar support is provided by the Ontario Research Fund, Alberta Innovates, Innovate BC and the BC Knowledge Development Fund, Research Nova Scotia, and the Saskatchewan Health Research Foundation, among others.

16 Homepage | Fonds de recherche du Québec

Academia

University of Guelph

The University of Guelph is the top-ranked Canadian University in food science, as well as in research dollars spent. With almost 30,000 students and operating 13 farms across the province of Ontario, Guelph has the ability to undertake targeted research across a range of temperatures, soils, humidities and rainfall microclimates.

The University is undertaking novel research initiatives, including developing a Protein Institute to build greater understanding of the future industry and consumer needs, and the work within the Plant Agriculture department for alternative fertilisers through probiotic microbial work to enhance crop yield, stress resistance and soil health. Other projects include biosynthetical pathway control to develop novel nanoemulsifiers like rhamnolipids, and using fungal mycelium for novel plastics and fibres.

McGill University

McGill University was founded in 1821 and has hosted students from over 150 countries. Within its Agriculture and Environmental Sciences department, McGill holds over 650 hectares of land on its campus – covering farming, urban forests, seed farms and animal research centres. Some further international research is undertaken through the federal New Frontiers in Research Fund and Horizon Europe project applications.

The University's focus is centred around six sustainability, health and productivity themes, including work in this sector around bioproducts, biomaterials and bioenergy. Current scientific research is taking place in the microbial and molecular space, which includes engineering yeast for terpenoid production (the Ignea Lab), as well as plant biochemistry and waste-water contaminant removal and recovery.

Université de Montréal

The Université de Montréal is one of Canada's top five universities, and second in student numbers, including a number of French international students. The University's Department of Chemistry leads a collaborative approach to topic areas around the EngBio space, including green chemistry, glycoengineering, catalysis, organic and novel molecules, continuous flow synthesis, mineral extraction, and wider work around process and infrastructure optimisation.

The University offers travel awards, scholarships, symposiums and workshops as part of its efforts to drive collaboration, knowledge sharing and skills development among its scientific researchers – while also playing a key role in the region's academic cluster for science with McGill and other institutions.

GEM Delegation touring Saskatchewan Food Industry Development Centre

Businesses and Sector Experts

Businesses operating in the Clean Technology and Manufacturing sector have attracted significant investment in recent years, with a demand for developing EngBio bioremediation strategies in mining waste. One example is Metabolic Technologies, a spin out from the University of British Columbia (UBC), which has developed a genetic engineering approach to remove toxic compounds from oil sands tailings ponds.[17] Elsewhere, the Global Institute for Food security (GIFS) is building a state-of-the-art EngBio platform at the University of Saskatchewan (USask) to support strain engineering, proteomics and metabolomics support to research organisations and public and private sector companies.[18]

In food applications, Canada is also one of the leading countries that has invested in alternative protein technologies that incorporate elements of EngBio in precision fermentation and cultivated meat. Protein Industries Canada (PIC) recently announced an additional funding of CAN $10.9m dollars to strengthen Canada's plant-based ingredient supply chain by focusing on genomics research and AI application.[19] In 2021, USask was awarded CAN $3.2m dollars by the Canada Foundation for Innovation (CFI) to build a unique bio manufacturing facility using EngBio technologies to accelerate Agri-Food innovation.[20]

17 UBC startup acquired by Bill Gates backed company | Business Intelligence for B.C
18 GIFS at USask puts engineering biology to work | GIFS
19 Protein Industries Canada announces additional $10.9m for crop genomics and AI programmes | New Tech Foods
20 USask awarded $3.2M towards first-in-Canada engineering biology centre for ag innovation | GIFS

Saskatchewan Food Industry Development Centre (The Food Centre)

The Food Centre[21] is Saskatchewan's leading food incubation facility, helping agri-businesses from start-ups to Fortune 500 companies with the evolution of novel products and the commercialisation of new food concepts.

A not-for-profit enterprise boasting staff with more than 200 years of combined experience in food science and processing, the Food Centre has developed a strong reputation within plant protein development, bioengineering and fermentation, as well as extrusion and downstream processing. They currently work with long- and short-term processing, as well as providing other services to regional, national and international clients.

Initially funded through the Agri-Food Innovation Fund, the Food Centre now has three sites for supporting the sector, with the Pilot Plant and Agri-Food Innovation Centre recently joined by the new Advanced Food Ingredients Centre in 2023 that houses the bioengineering and fermentation capabilities. Recent investments have now provided up to 20k litres of food-grade fermentation capacity at the Food Centre, and the facility can act as an early-stage co-manufacturing partner to help clients test new food products in the Canadian market.

21 Homepage | Saskatchewan Food Industry Development Centre

UK Delegation touring the Global Institute for Food Security

Global Institute for Food Security (GIFS)
Founded in 2012 collaboratively by the University of Saskatchewan, Nutrien and the Government of Saskatchewan, GIFS[22] was created to help support businesses and researchers in the food innovation space with leading facilities, equipment and technologies for research and development of novel solutions.

GIFS offers expertise and cutting-edge technologies in areas such as accelerated breeding for plants and livestock, bio manufacturing and precision fermentation, data and analytics, and genomics and technical services.

Neptune Bioinnovation Centre (NBC)
Newly opened in 2025, the NBC[23] is a 51,000 sq. ft facility in Dartmouth, Nova Scotia, offering Contract Manufacturing Operations (CMO), industrial space, spray drying and precision fermentation facilities on a significant scale.

As part of the Canadian government's support for Nova Scotia as a home for clean technology, life sciences and health tech, a CAN $5 million contribution was made to facilitate the development of the NBC bio-innovation hub.

The centre will support both national and international users, and aims to encourage biotechnology advancements in areas such as smart materials, bioplastics, functional foods, green chemicals, therapeutics and alternative proteins.

22 Who We Are | GIFS
23 Establishing Canada's first large-scale bioinnovation centre | Government of Canada

International Cooperation

2025 Growth and Innovation Partnership

As part of a Joint Statement in June 2025 following a meeting between the Prime Minister of the United Kingdom and Prime Minister of Canada, a Growth and Innovation Partnership was agreed, announcing further collaboration on trade, science, technology and innovation.[24] The Partnership announced a strengthening in a number of key technology areas, including bio manufacturing and critical minerals.

2024 Memorandum of Understanding

The UK and Canada signed a Memorandum of Understanding (MOU) in January 2024 that focused on science, technology and innovation. It identified a number of key technology areas for mutual focus, including clean energy and EngBio, as well as wider AI and technology sectors.

The MOU follows a previous joint-research agreement in 2017 and includes an Annex to extend the scope of the MOU for emerging technologies and priority areas as they develop during its 10-year duration.

As well as focusing on novel research techniques and efforts to scale solutions towards commercialisation, the MOU also strives to align regulatory and governance principles for the good of the global sector as a whole.

2023 Biomanufacturing programme

In June 2023, UK and Canadian ministers signed a Memorandum of Cooperation[25] creating a Bio manufacturing Collaboration, a key part of which is a £20 million joint programme, as one part of wider collaborative efforts to align the UK and Canada's continued partnership links.

The Biomanufacturing Collaboration is designed to grow the bio manufacturing sector between the UK and Canada to drive economic growth and to ensure both countries are fully prepared for future pandemics. It includes support of joint R&D projects, the creation of a talent and skills pipeline, and a focus on getting more businesses to scale, bringing economic and employment benefits in this space to both countries.

Alternative Proteins collaborative R&D

In 2023, Innovate UK worked alongside Protein Industries Canada to deliver a £6.5 million investment opportunity to support novel concepts in alternative protein sources. As well as focusing on plant-based foods and the optimisation of their growth and production, the funding covered applications that utilised key EngBio areas of precision fermentation and innovation around the valorisation and circular use for by-products and waste created through novel food processes.

24 Joint statement between the Prime Minister of the United Kingdom and the Prime Minister of Canada | GOV.UK

25 UK Science Minister unveils over £24 million in new science and innovation agreements to deepen collaboration with Canada | GOV.UK

06. Collaboration Opportunitites

Innovation Partnership

With greater prioritisation and direction to the development of Engineering Biology technologies in the UK, academic partnerships for the UK and Canada's Green Chemistry and nascent non-life science engineering biology research offers real opportunities. During discussions, applications of bio-based technologies were of keen interest to develop and integrate with more green-chemistry focused expertise and capabilities in Canada.

Ongoing partnerships include:

- GlycoCell in the UK and the GlycoFlow project in Canada are both undertaking research around biomolecules and the interactions between biologicals and chemicals. With both countries' research at different stages of development, there is an opportunity for partnership and new research connections.
- McGill University has shown a key interest in completing joint Lifecycle Assessment and Techno-Economic Assessment work with the UK that focuses on areas such as water treatment for microplastics and iron recovery, as well as lithium-ion extraction collaboration. This presents an opportunity for the UK's Environmental Biotechnology Innovation Centre (EBIC) and other UK resources.
- NRC Royalmount were keen to discuss the potential of a collaborative project with the University of Edinburgh around bioleaching and biomining for mining samples and potential mineral recovery through microbes.
- The Universities of Toronto and Waterloo are each working on research projects on waste treatments around water, biogas, hydrogen and anaerobic digestion – including work with microbiome engineering and fatty acids. These concepts could benefit from connecting with EBIC and further UK expertise in these spaces. Building bridges between academia and early-stage SMEs would also support the development of some of these concepts.
- The Global Institute for Food Security (GIFS) have designed an engineering biology platform (biofoundry) in Canada and supports single-source integration for high-throughput measurements. Their recent work on alternative microbial chassis development presents an opportunity for co-development and discussions with UK institutions – particularly in microbial, algae and marine systems.

Scale-Up and Collaboration Support

During the GEM there was keen interest across the country to support bi-lateral collaboration and connect international stakeholders to innovation enablers. The facilities for scale-up and willingness to collaborate on engineering biology technologies with established organisations offer real opportunities, including:

- Genome Quebec's technology platform provides a one-stop-shop facility for whole genome, single cell and other targeted sequencing techniques. Its services are available to UK SMEs who may be looking to explore research opportunities in Canada
- Canadian stakeholders outlined that a range of innovative solutions are required across the country to valorise and create circularity in a vast array of waste and by-product streams. These include forestry, wool, paper and pulp, crops, livestock wastes, and water treatment, among many others, where Canada benefits from substantial natural resources. Most of these are areas of focus for UK innovation and offer a chance to map UK solutions to Canadian problem statements in these fields. For UK researchers and SMEs, this could allow the huge scaling of solutions where capacity and demand in the UK is small, but where Canadian partners can offer access to significant volumes of by-products, which could offer mutual benefit for future partnerships.
- The University of Guelph (UofG) are developing a Protein Institute to create a comprehensive understanding of proteins among local processors and stakeholders, looking at the value chain, processing cycle, environmental aspects and human digestibility. This has the potential to be a useful resource and opportunity to build collaborations with UK researchers and relevant industry.
- UofG also represents a significant resource for biomass, biochar, soil and plant science, cleantech, water and chemical research. This is new research in some areas and maybe benefit from knowledge sharing and collaboration from more established UK expertise.
- The Food Development Centre in Saskatoon offers high-quality pilot and demonstration-scale facilities for process optimisation, bioprocess intensification, and techno-economic validation. It also offers users access to bioreactors, fermentation platforms, and high-throughput analytics to help movement from lab to industrial scale. The Centre's integration of AI and machine learning for process monitoring and adaptive control also helps enhance scalability and reproducibility. Recent investments made in food-grade fermentation capacity allows for up to 20k litre volume of production.
- The Food Development Centre could be valuable as a way to help UK businesses scale into the Canadian and North American market for future engineering biology funding theme calls for Innovate UK and IRAP, acting as a manufacturing hub facility or simply as a fee-for-service service for UK SMEs.

McGill University

Roundtable Discussion

Networking And Ecosystem

Throughout the GEM, the spirit of collaboration was clear, with enthusiasm for Canada and the UK to work more closely together to learn from and benefit each other. Forging those bonds to bring different parts of the sector together with like-minded partners was seen as a real opportunity, and potential activity includes the following.

- Multiple Canadian stakeholders identified that a national grass roots movement would be valuable in bringing together founders, inventors, innovators, researchers and investors across the ecosystem into one collaborative space. As part of this, Canadian stakeholders would also like to work more closely with the UK sector to understand expertise and access to scale-up facilities. This provides opportunity to the establishment of a creative network and resource sharing systems for support and partnerships, as well as being an introductory path for UK experts into the Canadian sector.
- Work to map the expertise, facilities, resources and capabilities of both countries would also support greater connections, joint research support and commercial partnerships
- NRC IRAP continues to be a strong collaborative partner for supporting bilateral innovation and business support between the two countries. For Canadian projects, IRAP supports international opportunities, including overseas missions, both for knowledge sharing and business potential.
- International Conferences, such as SynbiTech in London in December, represent great opportunities for in-person meetings between stakeholders. There is real appetite to create wider programmes around such conferences in future that could contain workshops, networking and site visits.

Funding and Investment

Financial support mechanisms are essential to the development of novel research ideas and for helping move innovation towards commercialisation. The GEM visit identified a number of avenues that provide funding for the Canadian engineering biology ecosystem, including those who could support UK collaborative research involvement, or backing for UK businesses wanting to land in Canada.

- The Consortium de recherche et innovations en bioprocédés industriels au Québec (CRIBIQ) is a Quebec-based research community and funding consortium that supports the development of innovative bio-based projects. Its funding opportunities allow for the inclusion of international partners in projects, presenting an opportunity for UK academics, researchers and potentially SMEs to take advantage of.
- McGill University showed a keen interest in partnering with UK experts across dedicated Horizon Europe initiatives for areas such as new-to-nature molecules, terpenoids and preservatives for agrifood, as well as other biologicals. The university also has an active 'McGill Abroad' student exchange programme, with agreements in place with a number of UK universities – including Edinburgh, Manchester, Bristol and Kings College London for scientific placements.
- Invest Ontario and BioEnterprise Canada both provide some form of financial backing to overseas SMEs landing in the region, in terms of support for physical operations, funding opportunities and other incentives. Gaining further knowledge and details of these opportunities would help gain a clearer picture of the potential for UK SMEs to benefit from the support.
- The federal Sustainable Canadian Agriculture Partnership offers funding opportunities that can include international partners through both the Sustainable AgriScience Program and the AgriInnovate Program until 2028 (providing the main partner and work is located in Canada).
- The Innovate UK Investor Partnership model, where technical due diligence undertaken by an Innovate UK expert peer review helps investors not skilled in doing this themselves, was very popular among Canadian stakeholders. It provides the potential for UK and Canada to work together to translate these skills to the Canadian ecosystem and bring investors on board to learn more about assessments and value judgements as well.
- The Ontario Genomics (OG) BioCreates program offers similar commercial business support for SMEs to the Science Creates Accelerator in the UK for start-ups and some later-stage support across an 18-month period. It is currently primarily health-focused, but is expanding into the engineering biology space. The BioCreates program is very highly subscribed and offers access to infrastructure and business mentorship, which offer opportunities for future bilateral opportunities.
- Investissement Québec is also a good support option for international companies looking towards Quebec as a market and production location. There are schemes which could provide support for UK companies interested in a co-manufacturing deployment route, so this would represent a good connection for UK companies looking at Canada as a market, for example in the alternative proteins sector.

Regulation And Standards

With the engineering biology landscape developing globally, there is a clear need both for regulation to keep pace to support progress, and for agreed standards, processes and criteria to be created that instils consistency and measurability between countries' ecosystems. Some opportunities discussed during this GEM include:

- As regulation in this sector develops, greater collaboration and connections between the Food Standards Agency (FSA) in the UK and Health Canada could enable companies or researchers to move between markets more easily for mutual benefit.
- The regulatory Cell-Cultivated Product (CCP) sandbox in the UK has been very well received in Canada and praised for its innovative approach. It was believed this could present an opportunity for Canadian companies to either learn from the assessment results to build understanding, or to be involved in some capacity to support regulation development, or even to test their own progress so far.
- Creating standards across the ecosystem would help create consistency, as well as supporting market access and trade. There is significant benefit in creating internationally agreed frameworks and measures around quality, design, safety, measurement and composition, standardised testing, and product performance. This has not been done at an overarching level across the sector for agreed parameters, so represents an opportunity for the UK to lead the way in partnership with Canada in designing agreed standards to take forward. UK initiatives such as the National Alternative Proteins Innovation Centre (NAPIC) could support this.
- Both countries have strong and trusted regulation, and have the potential to be global flag bearers for standards in the developing engineering biology space. Greater collaboration between the UK and Canada would support the normalisation of engineering biology technologies within agri-food, clean technology and environmental solutions, while also enabling future international developments through closer UK-Canada partnership.

Market Access

Further collaboration between UK businesses in the Canadian market in the engineering biology space would create mutual benefits for sharing expertise and developing application opportunities, including:

- Waste valorisation is a key opportunity with significant applications for engineering biology solutions, due to Canada's vast natural resources. Across areas that include agriculture, wool, forestry, mining and water treatment, the UK can contribute to the development of novel solutions, innovative research, and commercial opportunities for transforming waste materials into new, more valuable products and energy.
- Underpinning a number of potential opportunities is Canada's interest and engagement with concepts that support a wider circular economy. This has been evident as a key government priority and ties in with a similar focus in the UK. This circular topic could therefore be the linchpin for expanding bi-lateral engineering biology collaborations between Canada and the UK.

07. Barriers to Collaboration

While there are many avenues to explore when it comes to collaboration around novel research and innovative business solutions, there are areas where either the two national ecosystems are yet to be aligned, or where processes and support mechanisms are yet to be fully developed. These should be considered before the implementation of new initiatives to ensure suitability and the potential of success with future activity.

Scaling and Capacity

- A number of stakeholders identified a bottleneck when it came to scaling infrastructure across the country. Across Quebec and Ontario, and reflected more widely, the lack of facilities – particularly around fermentation – make it harder for innovators to demonstrate viability for a move from proof of concept to industrial application.
- The international currency exchange rate between the two countries might make the use of UK facilities prohibitively expensive for Canadian researchers and businesses at the current time, whilst this may be an opportunity for UK researchers and companies that might want to explore using Canadian facilities.

Intellectual Property, Terminology and Regulation

- Inconsistencies in the use and understanding of terminology differ between Canada and the UK – particularly around what is covered by the terms engineering biology, synthetic biology and bioengineering. This has the potential to cause some confusion and misalignment with collaboration opportunities between the two countries and should be considered when establishing bilateral opportunities and future partnership building activities.
- There is a perception among Canadian stakeholders that there has been little regulatory development so far across the engineering biology space, and that there is a lack of engagement for regulators with researchers, founders and innovators around standards and guidelines.
- There are differences in agreements and expectations around the ownership of IP across the country, and between different types of collaboration and scaling paths. Stakeholders expressed confusion around what to expect around negotiating IP when combining invention within university research, independent facilities (e.g., colleges), or when negotiating investment and business development opportunities. Having the right support and advice is key for any UK stakeholder looking to collaborate with Canadian counterparts.

Facilities at the Saskatchewan Food Industry Development Centre

Provincial and National Landscape

- The provincial picture in Canada shows some hurdles around the alignment of funding opportunities, capacity and capabilities, skills and expertise, and regulatory involvement. Some regional stakeholders felt a greater collaboration and understanding was needed for the ecosystem as a whole, to identify how other activities across Canada could support their own progress.
- Canada has an internal challenge of its substantial size and distance as a country, creating an issue of time and expense for researchers and start-ups around transport, logistics and collaboration, among other areas.
- Since the introduction of tariffs by the US, a 'Canada first' mentality has become more prevalent around innovation, commercialisation, processing and manufacturing in order to help develop a stronger national ecosystem and more opportunities for Canadian stakeholders. This approach has the potential to inhibit the involvement of UK counterparts where funding rules stipulate the majority of activity and finances are required to remain in Canada as part of project scopes. At the same time there is a desire to diversify away from working with the US to working with trusted countries.

Funding and Investment

- While there is clear evidence of growing backing for testing and discovery of early-stage ideas and solutions, such as the GIFS and Food Centre commitments in new technology, there is still demand for further provincial funding support in order to help further scale up ideas towards the first steps of commercialisation.
- Stakeholders believed that there was a lack of venture capital funding in the Canadian engineering biology space and fewer angel investors were interested in the sector. This was seen as being connected to limited exit opportunities and the demand for faster returns than many of the experimental areas can offer at their current stage.
- Investors also felt they had a lack of technical expertise themselves to do appropriate due diligence on early-stage engineering biology opportunities in this nascent sector. Greater regulation, standards and external expertise were required to support investors in understanding and decision making.
- Many researchers, innovators and SMEs felt there was a real need for better communication from federal and provincial government around the funding opportunities that are available. There was a common perception that these stakeholders aren't aware of all the potential funding and backing they could apply for or take advantage of from different sources, and that more was needed to engage with the engineering biology sector to advertise these beneficial offerings.

08. Conclusions

The Global Expert Mission visit highlighted a real willingness among Canadian stakeholders to engage more closely with the UK, as they see value in a strategic bilateral partnership in many areas as the engineering biology sector continues to develop in breadth and scale.

Throughout the GEM, there was an acknowledgement that the UK currently has a more developed sector in some key areas within Engineering Biology, and that this expertise could support crucial learnings for Canadian counterparts. This was most prevalent in topics around novel mineral recovery innovations, regulatory engagement through the FSA and CCP Sandbox, and the UK's ability to form collaborative national networks and partnerships across the ecosystem.

There is huge potential for the Canadian EngBio sector to develop at pace towards commercialisation, thanks in part to the national interest in a Circular Economy and the nation's vast natural resources. From fresh water to natural gas, and mining to forestry and agricultural plains, there is widespread opportunity for engineering biology solutions to support remediation, resource recovery, alternative proteins, waste and by-product stream valorisation, and a range of other circular economy pathways on a very large scale.

There is now a real demand within Canada to maximise this opportunity through greater collaboration, partnership and knowledge sharing across stakeholders able to support co-innovation for mutual benefit.

The early-stage engineering biology sector in Canada is thriving in many respects. Innovative new ideas are commonly supported through lab-scale testing by universities and wider funding support, while state-of-the-art facilities exist in different key locations that are helping to identify novel products, methods and solutions to engineering biology opportunities. The next challenge for the Canadian sector is to develop greater capacity and capabilities to support scaling to the next stage of development towards proof of concept and commercialisation. Having the regulation, infrastructure and expertise to meet the potential of Canadian engineering biology innovation is a priority.

In light of the above, the GEM discovered a real opportunity for mutual partnership between the UK and Canada in the engineering biology space. The two countries have a similar mindset towards supporting innovation and developing a collaborative network to help drive progress forward.

The UK possesses some key expertise and novel research concepts that would support many of the problem statements identified in the Canadian market, while Canada offers the natural resources and know-how to take successful businesses and research to a much larger environment for deployment, given the size and scale of production across key industry sectors in the country and the size of the North American market.

Building on this collaborative opportunity through greater connections, partnership, funding and business support could see the two countries establish a truly beneficial relationship in the global engineering biology space.

UK Delegation at NRC Saskatoon

09. Annex 1

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