Life Sciences in British Columbia: Sector Profile

June 2020

BRITISH COLUMBIA

Foreword

This report results from a collaboration between the Province of British Columbia, LifeSciences BC, and Global Affairs Canada, with input from many partners including Western Economic Diversification, Innovation, Science and Economic Development Canada, British Columbia's public post-secondary institutions, and life sciences companies. It presents an overview of the life sciences sector and its ecosystem in British Columbia, highlights the sector's economic contribution to the province, and outlines the assets and resources that contribute to its growth potential. This document may be revised and updated regularly and may serve as a reference and baseline to monitor the evolution of the life sciences sector. The statistics presented aim to create consistency across Canada in the way the life sciences sector is examined.

This report was written prior to the COVID-19 pandemic.

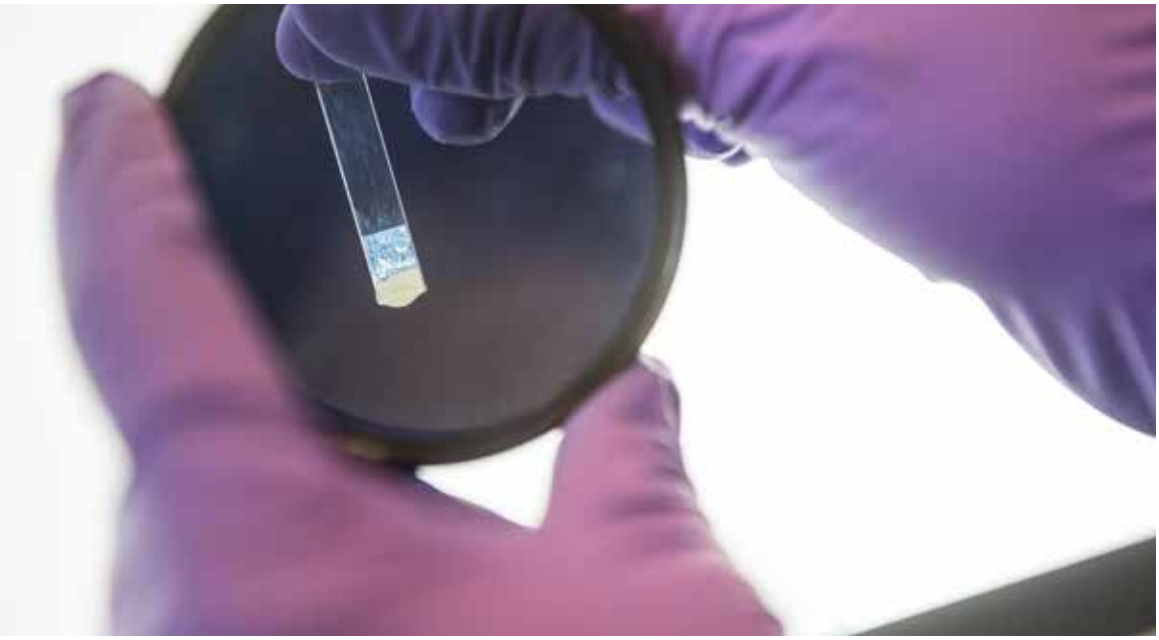


Image courtesy of the University of British Columbia

Contents

Message from the Minister of Jobs, Economic Development and Competitiveness

Michelle Mungall
Minister of Jobs, Economic Development and Competitiveness

British Columbia has a strong history of innovation and leading life sciences initiatives that result in promising advances for people and the economy. The passionate people who work in the life sciences sector throughout British Columbia are committed to finding ways to create life-saving products and offer innovative services for the citizens of B.C. and beyond.

British Columbians are incredibly proud of the innovative life sciences work that is happening throughout the province. The technological advancement developed by local companies and research organizations, especially in healthcare, exemplifies the province's world-class capability and demonstrates innovation that has had lasting impacts both locally and globally.

Our government realizes the importance of supporting research, innovation and production in the life sciences sector. Through a variety of private and public investments, British Columbia's life sciences sector is well-positioned to seize new opportunities and create tailored and innovative solutions that continue to drive economic growth.

Special thanks to LifeSciences BC; Global Affairs Canada; Western Economic Diversification; Innovation, Science and Economic Development Canada; post-secondary institutions; and life sciences companies for their contributions to this report. A further thank you to BC Stats, the office of the Innovation Commissioner and staff from the ministries who provided data, and thoughtful oversight in its development.

I hope that the information contained in this report will serve as a reference for many, and that this work has also reinforced the collaborations that support the continuous advancement of the sector and its contribution to the well-being of British Columbians.

Sincerely,

Michelle Mungall
Minister of Jobs, Economic Development and Competitiveness

Executive Summary

This report describes British Columbia's life sciences sector and the economic contributions of the sector and its ecosystem. British Columbia's growing life sciences sector is showing signs of maturation and has recently demonstrated its significant and attractive potential for investment.

Within a context of globalization, aging demographics, and increasing demand for accessible digital and medical health technologies and pharmaceuticals, the life sciences industry is transforming: traditional global business models are becoming more collaborative; leading-edge biotechnology (biotech) firms are leveraging partnerships with health research communities; and global companies are increasingly diversifying their research and development through contracting out, investing in third-party research through business development activities, and engaging in licensing arrangements.

STATISTICAL PROFILE OF THE SECTOR:

In 2018, British Columbia's life sciences sector was comprised of approximately 1,120 companies with employees, including those within the following industry groups: "Research, Testing and Medical Laboratories"; companies designing and manufacturing "Medical Devices and Equipment"; and companies producing "Drugs and Pharmaceuticals".[1] Most (93%) of these companies tend to be small, with fewer than 50 employees.

Over 17,300 people were employed in the sector, earning relatively high wages ($1,322 weekly). The life sciences sector is one of British Columbia's fastest growing sectors, with employment increasing by 5.6% between 2017 and 2018. Its growth is supported by a dynamic post-secondary system that enrolled 22,500 students in life sciences-related academic programs in 2017/18, a 13% increase over four years.

In 2018, British Columbia's life sciences sector recorded almost $5.4 billion in revenue and produced $1.6 billion in GDP.[2] The province exported $484 million in life sciences goods and services in the same year.

Although relatively small compared to the province's natural resources sector, and third in size behind Ontario and Quebec in terms of sector employment, wages, revenue and gross domestic product, British Columbia's life sciences sector plays an important role in supporting the provincial health care system and is increasing global trade, including with European and trans-Pacific markets. Exports of life sciences services are growing especially fast, reflecting the strengths of the province in this area.

1 These categories are derived from the North American Industry Classification System. The statistical method used for this report has been developed by BC Stats and partners to allow for long-term monitoring of the sector and comparison across jurisdictions.

2 Chained 2012 dollars.

British Columbia is the second largest exporter of medical devices after Ontario and is the primary exporter of ultraviolet and infrared ray equipment in Canada, with 83% of the country's total exports. British Columbia is a leader in antibodies (e.g., creation of a new global pandemic prevention platform for discovering antibodies) and is also the number one exporter of prostheses with 81% of Canada's export value share to European Union markets. British Columbia's vitamins and medicines exports to the U.S. have soared from several thousand dollars in 2017 to over $6 million in 2018.

UNDERSTANDING BRITISH COLUMBIA'S LIFE SCIENCES SECTOR AND ITS ECOSYSTEM:

In 2019, British Columbia biotech companies raised record financing, with close to $700 million from the top four deals and an additional $200 million raised in the first quarter of 2020, signaling the growth potential of the sector. British Columbia is home to Canada's two largest biotech companies (by market cap) and Canada's largest medical device design company.

British Columbia's life sciences sector is supported by a cohesive ecosystem including:

- Industry associations like LifeSciences BC and the BC Tech Association;
- Research funding organizations like Genome BC, the Michael Smith Foundation for Health Research, and the Canadian Institutes of Health Research;
- Provincial and federal government entities including Innovate BC, Western Economic Diversification, and Canadian trade commissioners that support innovation and facilitate connections;
- World-class research institutions and research centres (such as Vancouver Coastal Health Research Institute with its nine research centres) that benefit from state-of-the-art equipment;
- Clinical trials networks that support over 1,200 clinical trials at 100 sites in British Columbia – a high proportion of all clinical trials conducted in Canada; and,
- Key provincial or federal initiatives like the Digital Technology Supercluster and the Cascadia Innovation Corridor that further the momentum and creativity of British Columbia's life sciences sector.

This report indicates that British Columbia's life sciences sector is well poised to continue its maturation: the sector's capacity to sustain growth in the face of changing economic landscapes is demonstrated; it has a strong capacity for collaborative research with industry; its highly skilled life sciences workforce is increasing; and its expert biotech, medical technology (medtech), and digital companies show that they can offer innovative products and services of interest to global companies and investors.

With continued investments, collaboration, and a growth in demand for British Columbian goods and services, the provincial life sciences sector **can seize new opportunities, leverage science to drive tailored and innovative solutions adapted to emerging global business models, and continue to drive economic growth.**

General Context

British Columbia's life sciences sector contributes to Canada's long history of leadership in international scientific advancements. Leading academic research has been a cornerstone of the development of the life sciences sector in the province, setting the tone for collaboration and providing opportunities for entrepreneurship.

The province's many contributions to life sciences include the University of British Columbia (UBC) biochemist Michael Smith's 1993 Nobel Prize winning technique for site-directed mutagenesis, the world's first treatment of age-related macular degeneration,[3] and twenty years of the BC Cancer Genome Science Centre's contributions which have had lasting impacts locally and globally.[4] New frontiers of life sciences innovation in the province include 3D printed tissues for medical use, antibody science, and genomics-based precision medicine.

Within the current context of globalization, technological advancements, and aging populations, the markets and focus of life sciences industries are shifting. Big data, quantum computing, digital health, and precision medicine are increasingly supporting innovation in the sector, while mobile, aging, and remote populations are driving the development of wearable technologies and the demand for more medical devices both domestically and globally.

These innovations and others supporting the healthcare industry, including pharmaceutical drugs, are increasingly complex and require collaboration across various industries and sectors.[5,6] The traditional global business models have been shifting to more collaborative models that contract-out research and development (R&D) and manufacturing, increase partnerships with health research communities, and leverage the capacity of leading-edge biotechnology firms.[7]

These emerging business models of collaboration and sectoral crossover can represent an opportunity for British Columbia because the province has strong R&D capacity, skilled biotech, medtech and digital companies, and – as demonstrated in this report – a capacity to sustain growth in the face of changing economic landscapes.

3 UBC Science. (December 2019). Historic Milestones. *https://science.ubc.ca/about/history*

4 BC Cancer. (December 2019). 20 in 20: Incredible ways the BC Cancer Genome Sciences Centre has made a global impact over the last twenty years. *https://tinyurl.com/ycne8ndj*

5 Government of Canada, Medical devices – Industry Profile. (June 2019). *https://www.ic.gc.ca/eic/site/lsg-pdsv.nsf/eng/h_hn01736.html#fn1*

6 Trade Commissioner Service (December 2019). Innovation thrives in Canada's life sciences ecosystem. *https://www.tradecommissioner.gc.ca/canadexport/0004169.aspx?lang=eng*

7 Government of Canada, Biopharmaceuticals and pharmaceuticals. (April 2014). *https://www.ic.gc.ca/eic/site/lsg-pdsv.nsf/eng/h_hn01777.html*

Statistical Profile of the Life Sciences Sector in British Columbia

Definition and approach

Life sciences is a growing sector for which the demand for information continues to increase. The sector typically comprises fields that involve the scientific study of living organisms. Technology developed by the life sciences sector has many practical applications including for health, medicine and pharmaceuticals, as well as agriculture and food science. The range of companies includes contract research firms, testing and medical labs, and companies that produce or sell medical devices, diagnostics, pharmaceuticals, and other reagents.

For the statistical profile presented in this report, the life sciences sector has been identified by aggregating existing industry sub-sectors coded under the North American Industry Classification System (NAICS. See Appendix A: Sources and Methodology, p.43). Although not perfect, this approach gives access to all the economic data collected by statistical agencies and typically attached to NAICS codes, including business counts, employment, wages, revenue, gross domestic product (GDP), and the trade of goods and services.

Approaching the life sciences sector through NAICS codes provides a good estimate of the sector profile from the economic data currently available. The figures in this report give a reasonable indication of the size and growth of the sector in the province and of its relative size compared to other regions for which estimates were calculated by using similar NAICS codes and methodologies.

The core definition of the life sciences sector includes three main groups of NAICS codes,[8] referred to throughout this report as industry groups:

1. Research, Testing and Medical Laboratories
2. Medical Devices and Equipment
3. Drugs and Pharmaceuticals

To remain focussed, this report does not include the extended definitions used in several reports from other jurisdictions. Those extended definitions often include the health care sector as a whole and may give a skewed idea of the size and impact of this sector.

8 See Appendix A for the detailed composition of the life sciences industry groups.

Due to limited available data, the following segments are not included in the statistical analysis in this report:

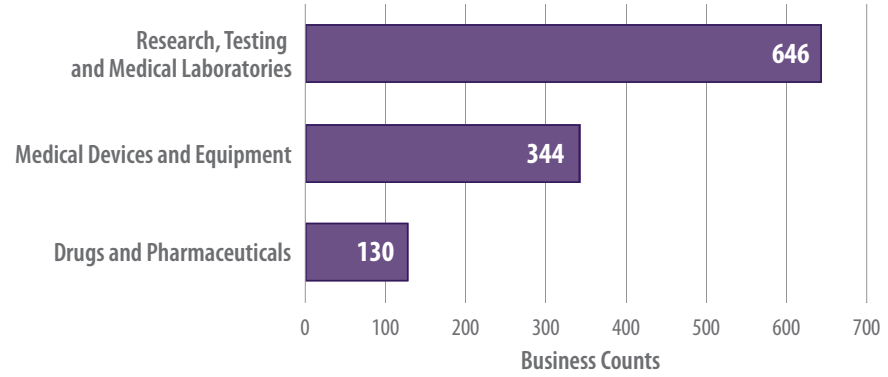
- Medical cannabis is not yet included in British Columbia's description of the life sciences sector because data are primarily based on voluntary crowdsourcing surveys. Since cannabis was legalized in Canada in October 2018, the medical cannabis industry has grown substantially.[9] Medical cannabis may be included in future reports.
- Digital health and information technology (IT) companies that support the life sciences sector may not all be included in the statistics of this report and this segment is described qualitatively. These companies are primarily captured in the IT segments of the British Columbia economy.

Unless otherwise stated, the statistics reported in this document were derived from BC Stats with the methodology described in Appendix A: Sources and Methodology, p.43.

Sector counts and trends in British Columbia

In 2018, British Columbia's life sciences sector included approximately 1,120 businesses with employees, of which 646 (58%) were in the Research, Testing and Medical Laboratories industry group (Figures 1 and 2). The Medical Devices and Equipment industry group is represented by 344 companies (31% of the sector), while the Drug and Pharmaceuticals industry group is represented by 130 businesses (12%).

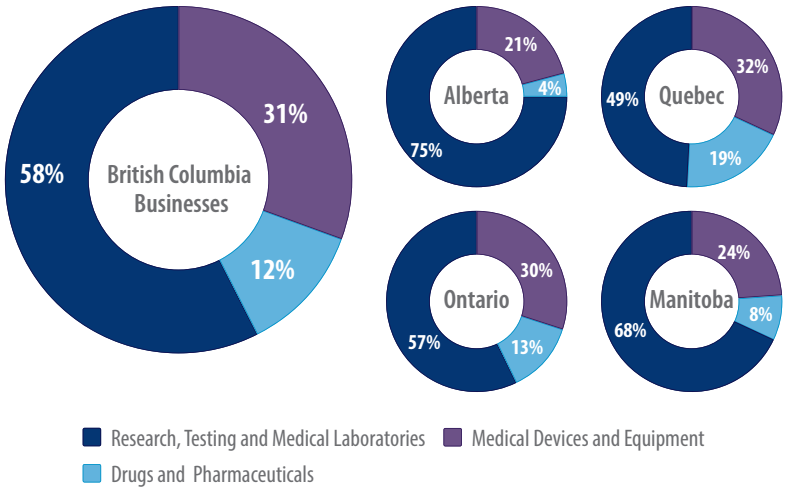
Figure 1: ***Business Counts in the Life Sciences in British Columbia by Industry Group, 2018***



Source: BC Stats. This figure excludes businesses without employees.

9 Statistics Canada. *Table 36-10-0601-01 Cannabis income account (x 1,000,000).*

Figure 2: ***Life Sciences Businesses in British Columbia – Breakdown by Industry Group, 2018***



Source: BC Stats. This figure excludes businesses without employees.

The number of businesses with employees in British Columbia's life sciences sector in 2018 grew by 4.8% over the previous year (Table 1), which exceeded the national growth rate of 2.9% and ranked the province fourth in the country for the number of businesses, behind Ontario (2,801), Quebec (1,282) and Alberta (1,213).

Table 1: ***Life Sciences Businesses with Employees by Province***

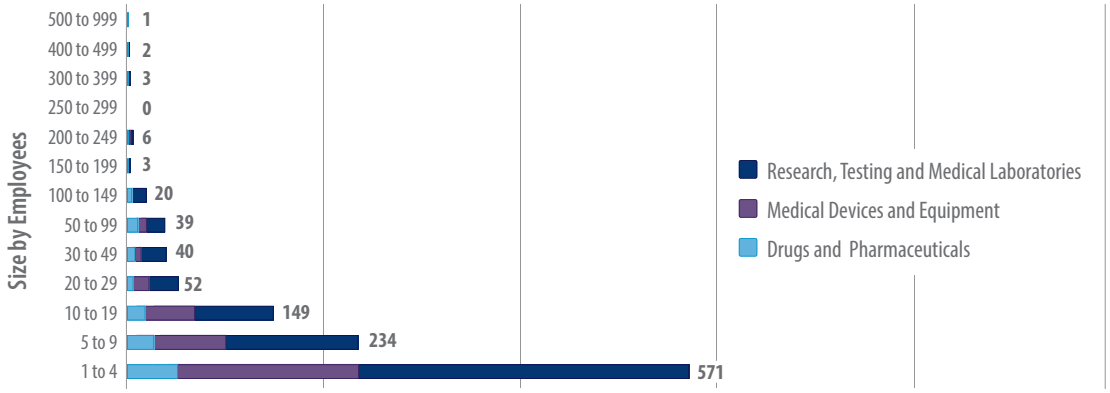
PROVINCE	2017	2018	% CHANGE 2017/2018
British Columbia	**1,069**	**1,120**	**4.8**
Alberta	1,190	1,213	1.9
Saskatchewan	195	190	-2.6
Manitoba	219	215	-1.8
Ontario	2,700	2,801	3.7
Quebec	1,249	1,282	2.6
Canada	6,910	7,110	2.9

Source: BC Stats. This Table excludes businesses without employees.

For the most part, British Columbia's life sciences businesses tend to be small operations (Figure 3). In 2018, around 93% of the province's life sciences companies had fewer than 50 employees. Just over half of life sciences businesses with employees had fewer than five people working for them. In addition, 937 life sciences businesses had no employees, bringing the total number of businesses to 2,057. The number of businesses without employees could be used as a proxy for self-employment in the sector.[10]

10 Note that these figures are only approximations of self-employment, because they could also include companies that hire only contractors, or companies with unpaid family workers. It would be incorrect to add these counts of self-employed to the total number of life sciences workers reported elsewhere in this report due to the differences in what is being measured.

Figure 3: ***Life Sciences Businesses by Size in British Columbia, 2018***



Source: BC Stats. This figure excludes businesses without employees.

Geographical poles of activity

The majority of British Columbia's life sciences companies are located in the Lower Mainland/Southwest region. This represents 734 companies and approximately 66% of the province's total.[11] Metro Vancouver alone is home to 62% (693) of the province's life sciences businesses, followed by the Vancouver Island/Coast and the Thompson-Okanagan regions, with 14% (160) and 11% (121) respectively. Approximately 8% of life sciences businesses are located in outlying regions of the province, represented by 87 companies.

Most of British Columbia's life sciences businesses are located in major city centres and in proximity to major research centres, hospitals and universities of note in the industry.

Amgen *is a leading global biotech company that specializes in developing medical treatments to fight cancer, bone disease, kidney disease, rheumatoid arthritis, cardiovascular disease and other serious illnesses. Amgen Canada employs about 400 staff, and its R&D facility – located in Burnaby, British Columbia – employs over 60 highly trained personnel. Many of Amgen Canada's proprietary research innovations were developed or invented in British Columbia – a testament to the scientific talent pool it has trained and who work in the province. Amgen has developed five flagship biomedicine products available to patients around the world: Vectibix® (panitumumab), Xgeva® (denosumab), Prolia® (denosumab), Repatha® (evolocumab), and Aimovig™ (erenumab).*

11 These percentages are calculated using the total less those businesses for which the region is unknown.

Economic Contribution

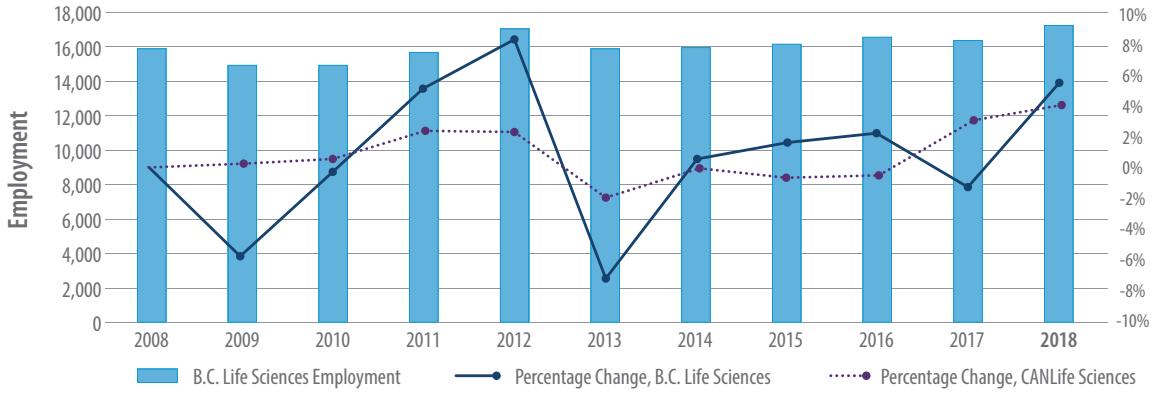
British Columbia's contributions to scientific and technological advancement in life sciences are becoming increasingly recognized both nationally and globally. Understanding the sector's contributions to the economy facilitates planning, increases the ability to draw upon strengths, and allows to offer targeted opportunities to international partners.

SECTOR EMPLOYMENT AND WAGES

British Columbia's life sciences sector employed 17,379 people in 2018, representing 0.7% of the province's total employment. The number of people employed in the sector remained in a relatively constant range over the past ten years, but a rapid 5.6% growth took place between 2017 and 2018 when the sector reached its highest employment point since 2008 (Figure 4). This recent growth of British Columbia's life sciences sector topped the 4.2% growth of the Canadian sector and matched that of Ontario.

This 5.6% employment growth extends well above the 1.1% total employment growth in the province and occurred in tandem with growth from the health care sector, highlighting the close relationship between the two sectors (Table 2).

Figure 4: ***British Columbia Life Sciences Employment***



Source: BC Stats. This figure excludes businesses without employees.

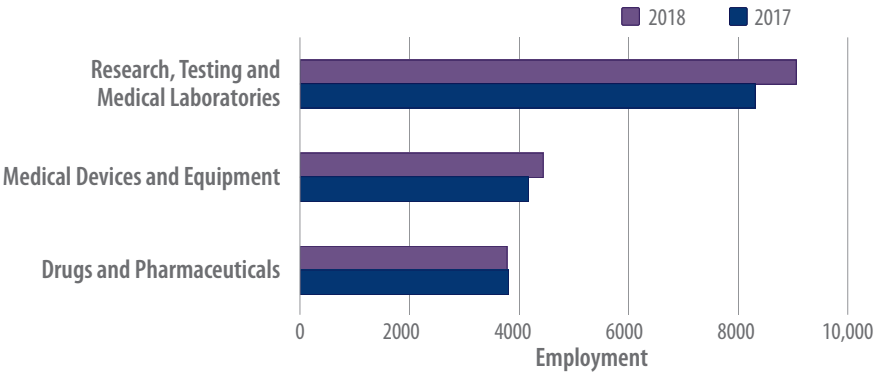
Table 2: ***British Columbia Employment by Industry (Thousands)***

INDUSTRY	% CHANGE 2017/2018
Utilities	7.8
Health Care and Social Assistance	6.5
Professional, Scientific and Technical Services	5.7
Life sciences	**5.6**
Construction	4.3
Other Services (Except Public Administration)	3.2
Accommodation and Food Services	2.8
Public Administration	2.4
Educational Services	1.2
TOTAL EMPLOYMENT	**1.1**
Manufacturing	0.1
Forestry, Fishing, Mining, Quarrying, Oil and Gas	-0.2
Retail Trade	-1.4
Wholesale Trade	-1.7
Business, Building and Other Support Services	-1.9
Transportation and Warehousing	-2.6
Finance, Insurance, Real Estate and Leasing	-3.5
Information, Culture and Recreation	-6.7
Agriculture	-9.9

Source: BC Stats

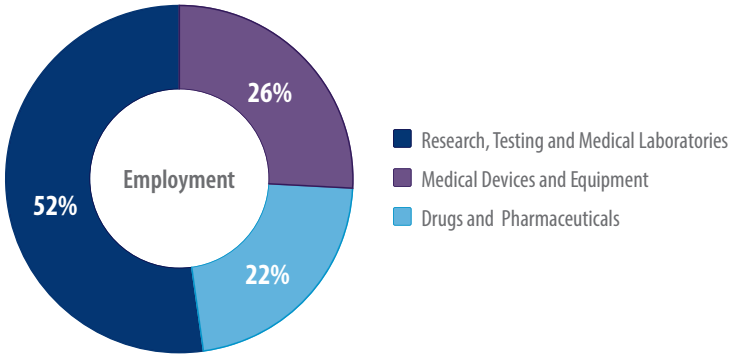
Of note is the 8.8% growth in employment in the Research, Testing and Medical Laboratories industry group (Figure 5). That group alone represents 52% of British Columbia's life sciences employment (Figure 6). The number of workers also grew in the Medical Devices and Equipment industry group, by 5.1%; just over a quarter (26%) of the province's life sciences workers were employed in that group. The number of employees of the Drugs and Pharmaceuticals industry group remained relatively stable (-0.8%); this group represents 22% of British Columbia's life sciences employment.

Figure 5: ***British Columbia Employment by Life Sciences Industry Group, 2018***



Source: BC Stats. This figure excludes businesses without employees.

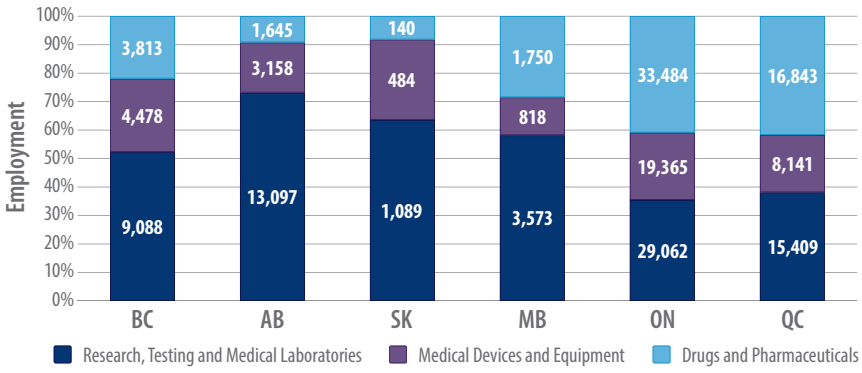
Figure 6: ***British Columbia Percentage Employment by Life Sciences Industry Group, 2018***



Source: BC Stats. This figure excludes businesses without employees.

British Columbia's employment in the life sciences sector (17,379) sits in the same range as Alberta (17,900) and follows Ontario (81,912) and Quebec (40,393). The ratio of employees per industry group varies between provinces. Both Ontario (41%) and Quebec (42%) have a larger workforce in the Drugs and Pharmaceuticals group, while Alberta (73%) and British Columbia (52%) have a greater share of employees in Research, Testing and Medical Laboratories (Figure 7).

Figure 7: ***Employment in the Life Sciences by Industry Group across Provinces, 2018***



Source: BC Stats. This figure excludes businesses without employees.

In 2018, the life sciences sector in British Columbia paid just under $1.2 billion in total wages, up 10.7% from 2017 (Table 3).[12] This exceeded the national wage growth rate of 8.8% in the sector and ranked the highest in the country, above Ontario (10.4% growth). The growth in U.S. life sciences wages, at 11.5%, was slightly higher than that in British Columbia. Among the provinces, Ontario and Quebec paid the most in total wages, at approximately $5.9 billion and $2.7 billion respectively in 2018. Alberta, at $1.16 billion, was just behind British Columbia in terms of total wages paid for life sciences employees. Thirty-one states in the U.S. paid out more in total wages than British Columbia.

Table 3: ***Wages ($CDN Millions) and Earnings ($CDN) in the Life Sciences Sector***

Region	Total Wages (Millions) 2017	Total Wages (Millions) 2018	% Change 2017/2018	Average Weekly Earnings 2017	Average Weekly Earnings 2018	% Change 2017/2018
British Columbia	**1,083**	**1,198**	**10.7**	**1,262**	**1,322**	**4.8**
Ontario	5,360	5,916	10.4	1,325	1,385	4.5
Quebec	2,523	2,701	7.0	1,204	1,282	4.1
Alberta	1,078	1,165	8.1	1,232	1,249	3.7
Manitoba	331	345	4.2	1,025	1,078	5.2
Saskatchewan	85	85	-0.1	972	953	-2
Canada	**10,883**	**11,844**	**8.8**	**1,283**	**1,340**	**4.4**
United States	207,231	231,081	11.5	2,389	2,504	4.8

Source: BC Stats. This figure excludes businesses without employees.

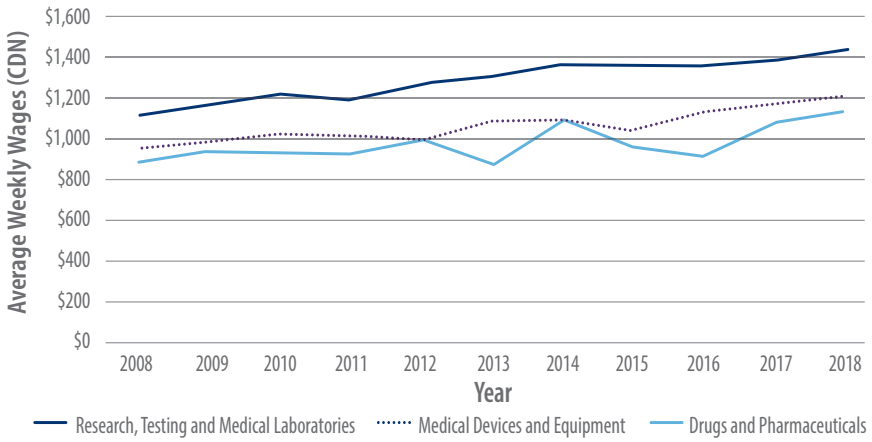
In 2018, the average weekly earnings of $1,322 for life sciences employees in British Columbia was slightly lower than in Ontario ($1,385) and Canada as a whole ($1,340). However, with an increase of 4.8% between 2017 and 2018, earnings grew faster in British Columbia than any of the provinces for which estimates were produced, with the exception of Manitoba where average weekly earnings grew by 5.2%, to $1,078.

The average weekly earnings also increased by 4.8% in the life sciences sector in the United States and wages were higher than those in Canada, with life sciences workers in every state earning more per week than their Canadian counterparts.

Broken down by industry groups, since 2008, the highest weekly earnings for life sciences employees in British Columbia has consistently been in the Research, Testing and Medical Laboratory group, while the lowest has most consistently been in the Drugs and Pharmaceuticals industry group (Figure 8). This group seems to be catching up, with weekly earnings growing by 5.6% between 2017 and 2018. The smallest increase of 3.5% was seen in the Medical Devices and Equipment industry group. The Research, Testing and Medical Laboratories group noted wage increases of 4.1%.

12 Note that wage, revenue and trade figures in this report are valued in current dollars as sufficient information is not available to calculate constant dollar figures; therefore, growth rates include the effects of inflation. All U.S. dollar figures have been converted to Canadian dollars using an average annual exchange rate.

Figure 8: ***British Columbia's Average Weekly Earnings by Industry Group***



Source: BC Stats. This figure excludes businesses without employees.

It should be noted that earnings varied significantly among the industry groups and across Canada. Wages for the Research, Testing and Medical Laboratories industry group in British Columbia were higher than the Canadian average for this group ($1,448 per week compared to $1,336 for Canada), but were lower than the Canadian average for the Medical Devices and Equipment, and the Drugs and Pharmaceuticals industry groups.

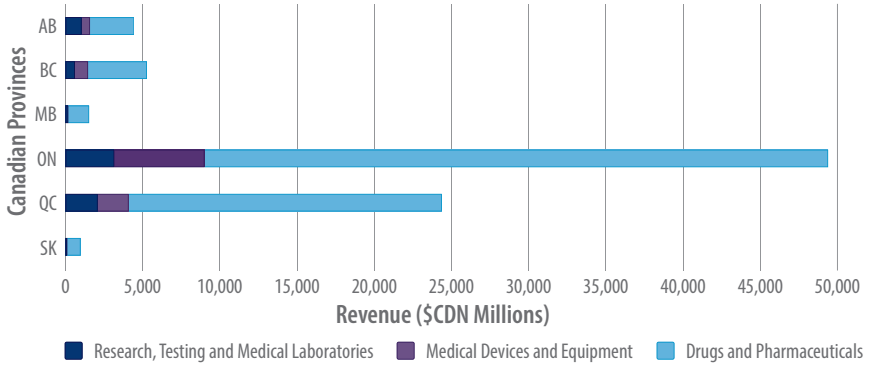
British Columbia *is home to one of the largest life sciences sectors in Canada after Ontario and Quebec, with employment and GDP growing faster in British Columbia than in the rest of Canada. The Research, Testing and Medical Laboratories industry group employs more people and contributes more to British Columbia's GDP than the other groups, but most of the revenue resides with the Drugs and Pharmaceuticals group. British Columbia's average weekly wages in the life sciences sector are close to Ontario's and growing faster than in most Canadian provinces.*

CONTRIBUTION TO PROVINCIAL REVENUE AND GROSS DOMESTIC PRODUCT (GDP)

In 2018, revenues in British Columbia's life sciences sector were approximately $5.4 billion (Figure 9), up 5.6% from the previous year and third in the country behind Ontario ($49.4 billion) and Quebec ($24.4 billion). British Columbia's growth rate was above the national growth rate of 5.0%.

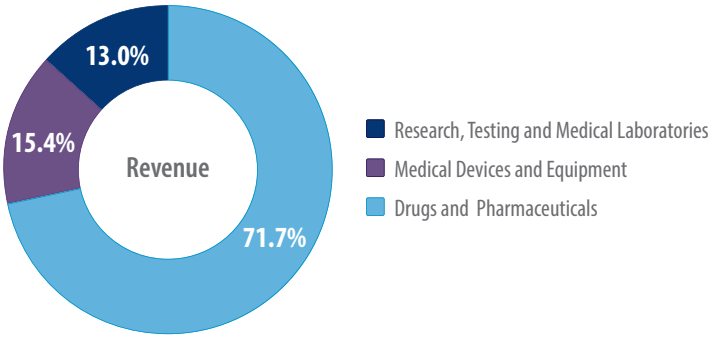
Despite representing only 12% of life sciences companies in British Columbia and 22% of employment, the Drugs and Pharmaceuticals industry group earned 72% of total life sciences revenue (Figure 10), totalling $3.8 billion, and is the top revenue generating life sciences industry group across all examined provinces. In British Columbia the Medical Devices and Equipment industry group generated around 15% of total life sciences revenue, or $822 million, while the Research, Testing and Medical Laboratories group generated just over 13% of revenues, totalling $695 million in 2018. The Drugs and Pharmaceuticals group was also the top revenue earner in the U.S. life sciences sector both nationally, and in all but ten states.

Figure 9: ***Provincial Revenue by Life Sciences Industry Group, 2018***



Source: BC Stats

Figure 10: ***British Columbia's Revenue by Industry Group, 2018***



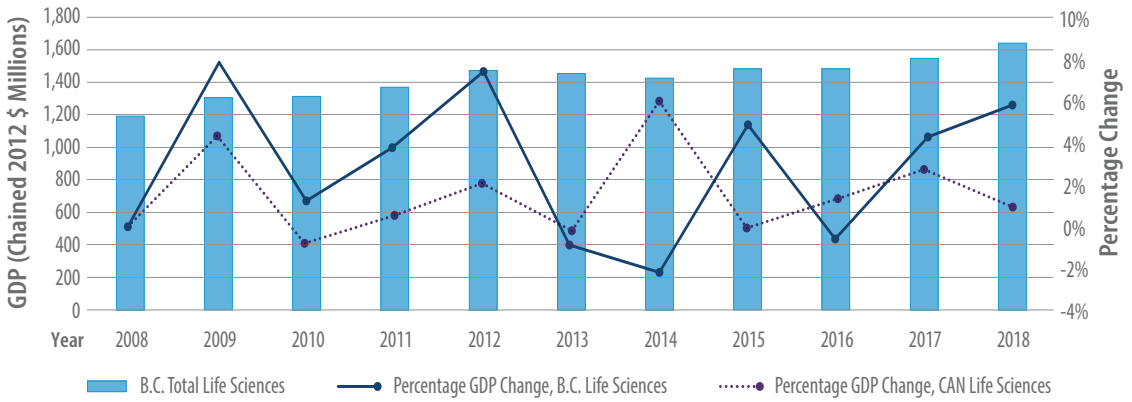
Source: BC Stats

GDP in British Columbia's life sciences sector was just over $1.6 billion in 2018,[13] an increase of 5.7% from 2017, exceeding Canada's life sciences GDP growth of 1.0% (Figure 11). British Columbia's life sciences GDP growth also exceeded the province's industrial aggregate GDP growth, which reached 2.7% for the same period.

The life sciences sector comprises around 0.7% of the province's total GDP. For Canada as a whole, around 1.6% of GDP is derived from life sciences, compared to 2.5% in the United States.

13 In chained 2012 dollars.

Figure 11: ***British Columbia GDP and Percentage Change in Real GDP from Previous Year***

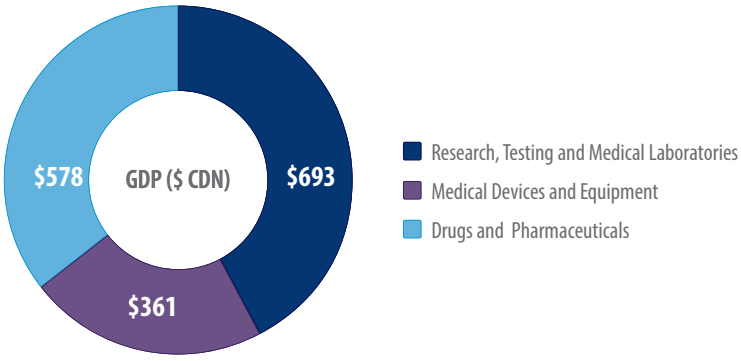


Source: BC Stats

British Columbia ranked third in the country in GDP produced by the life sciences sector in 2018. Ontario led with the largest output ($11.9 billion), followed by Quebec ($6.5 billion) and British Columbia ($1.6 billion). Alberta, with just over $1.5 billion, was close behind British Columbia, while Saskatchewan and Manitoba produced significantly less GDP from their life sciences sector with $189 million and $86 million respectively. In comparison, ten American states, including California, Texas and New Jersey, each demonstrated greater GDP production in 2018 by the life sciences sector than those produced across all of Canada.

British Columbia's Research, Testing and Medical Laboratories industry group produced $693 million in GDP, which was the most in the province's life sciences sector. The Drugs and Pharmaceuticals industry group recorded a GDP of $578 million, followed by the Medical Devices and Equipment group, which produced $361 million in GDP.[14]

Figure 12: ***British Columbia 2018 GDP in the Life Sciences Sector (Chained 2012 $ millions)***



Source: BC Stats

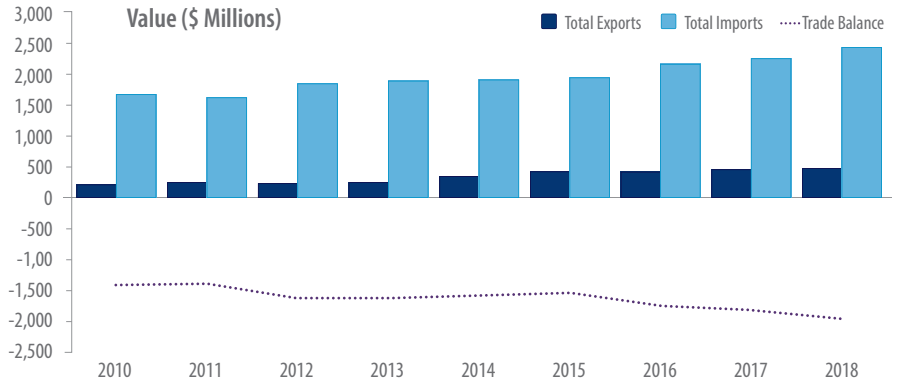
14 Note that chained dollar GDP values are not additive; therefore, industry group GDP will not add to the life sciences total and provincial GDP will not sum to the Canadian total.

TRADE IN GOODS AND SERVICES

In 2018, British Columbia exported approximately $484 million in life sciences goods and services to international destinations, which was approximately 7% of the Canadian total in this sector. Imports of life sciences goods and services amounted to $2.4 billion (Figure 13), or about 17% of all Canadian imports from the sector. As a result, the province had a deficit in trade in life sciences goods and services of around $1.9 billion.[15] The deficit was entirely due to trade in goods, as British Columbia recorded a surplus in trade in services of $163 million.

Canada also has a deficit in trade in life sciences goods and services. In 2018, the trade deficit stood at almost $6.9 billion. As with British Columbia, the national deficit was entirely due to low trade in goods, as Canada recorded a $1.9 billion surplus in trade in life sciences services. Likewise, the United States, which had an overall life sciences trade deficit of $17.2 billion in 2018, recorded a surplus in trade in services of almost $4.3 billion.

Figure 13: ***British Columbia Trade in Life Sciences Goods and Services***



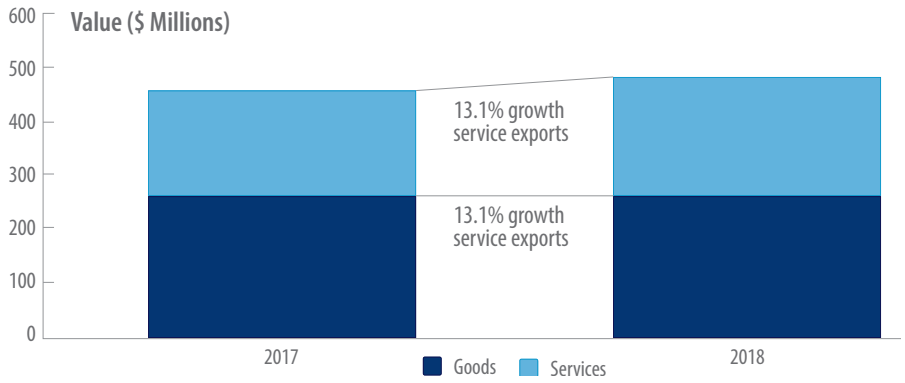
Source: BC Stats

British Columbia's life sciences goods exports totalled $261 million in 2018 and experienced a 0.4% decline from 2017 (Figure 14), well below the Canadian average growth rate of 1.5% for the sector in the same period. However, at $223 million, exports of life sciences services jumped 13.1%, which led the country and was substantially higher than the national average growth of 1.1% for the sector. Despite its impressive growth in 2018, British Columbia's exports of life sciences services accounted for only a 0.3% share of the overall provincial services exports. Exports of life sciences goods represented 0.6% of the province's total international commodity trade.

15 Note that the trade balance calculation includes $10 million in re-exports, which are goods imported into the province from an international origin, perhaps stored for a short period of time, then shipped out again without being materially transformed.

Overall, with regard to trade, the life sciences sector may have more similarities to the information technology sector than to traditional manufacturing or commodity-producing industries. Companies from the life sciences sector are exporting more services than goods, and Canadian projections predict a continuation of that tendency.[16] In British Columbia, the constant and substantial increase of services exported by life sciences small and medium enterprises (SMEs) since 2011 suggests an area of provincial strength, fueled by strong research and digital capacity.

Figure 14: ***British Columbia Life Sciences Exports Growth***



Source: BC Stats

British Columbia benefits from the many Canadian free trade agreements *and the interventions of trade commissioners to develop international markets in niche areas that demonstrate provincial strengths (see International Markets and Free Trade Agreements, p.44).*

British Columbia is the **second largest exporter of medical instruments** *after Ontario with 39% of export value share. The largest market for British Columbia medical devices and equipment is the U.S. ($88 million or 93% of all British Columbia's medical instruments exports).*

British Columbia is also the **main exporter of ultraviolet and infrared ray equipment in Canada** *with 83% of Canada's total exports and a strong export growth of around 70% in 2017-2018. In particular, British Columbia's exports of UV equipment grew significantly across the Comprehensive and Progressive Agreement for Trans-Pacific Partnership (CPTPP) (+242%), and Canada-European Union Comprehensive Economic and Trade Agreement (CETA) (+181%) markets.*

British Columbia is also the **number one exporter of artificial body parts** *with 81% of Canada's export value share. The European Union (EU) market is a key destination for the province's exports of prostheses with around $27 million in 2018, while the CPTPP countries account for 18% of total provincial exports. The value of British Columbia's vitamins and medicines exports to the U.S. has soared from several thousand dollars in 2017 to over $6 million in 2018, placing the U.S. ahead of the EU consumers. Nevertheless, the EU market remains a steadily growing destination for medicines made in British Columbia with 13% growth in export value recorded in 2018.*

Source: Government of Canada – Trade Data Online (January 2020).
https://www.ic.gc.ca/app/scr/tdst/tdo/crtr.html?&productType=HS6&lang=eng

16 Trade Commissioner Service. (December 2019). Canadian service exports are on the rise. *https://www.tradecommissioner.gc.ca/canadexport/0004321.aspx?lang=eng*

Founded in 1999, StarFish Medical *is Canada's largest full-service medical device product development company. Based in Victoria, the company turns client technology into commercial products. StarFish services include intellectual property development, human factors, industrial design, mechanical, electrical and software engineering, regulatory affairs consulting, supply chain management and specialty manufacturing.*

StarFish exports its professional services and cardiovascular device testing products worldwide and has helped 150+ clients to obtain patents spanning cardiovascular, digital health, ophthalmology, optics, and ultrasound medical devices. In 2015, StarFish launched the Medical Device Playbook event to improve Canadian medtech innovation and entrepreneurship in both Vancouver and Toronto.

In 2009, StarFish Group of companies acquired ViVitro Labs, a leading cardiovascular device testing company that offers equipment and services to organizations in over 40 countries. In 2019, ViVitro acquired ProtoMedLabs in Marseille, France to better serve European clients.

Digital Health and Artificial Intelligence

Digital health and artificial intelligence contribute to the innovation and growth of British Columbia's life sciences sector and increasingly change the capacity and focus of the industry.[17,18] Many companies create combination products and invest in digital technologies to address areas of unmet need. Some actively develop e-health products to increase the efficiency of the healthcare system, others incorporate information technology advances to increase their own efficiency.

Bioinformatics, systems, networks and algorithms all contribute to building the infrastructure and capacity necessary for a modern life sciences sector. These advances can play a role in ensuring the healthcare system is able to support increased or new demand for medical services. In future reports, efforts will be made to further clarify the economic contribution of digital companies to British Columbia's life sciences sector.

British Columbia is home to major digital health companies *like* ***TELUS Health*** *who invested $2.5 billion in the Canadian healthcare ecosystem over the last 10 years. TELUS Health has developed innovative tools to advance healthcare delivery, enhance medication management, and streamline communications. They recently launched Babylon in British Columbia to allow residents to visit doctors virtually.*

17 MDPI. (January 2019). Special issue on e-health and AI. *https://www.mdpi.com/journal/information/special_issues/eHealth_AI*

18 Business in Vancouver (BiV 2019). Digital Health. *https://biv.com/magazine/digital-health-2019*

DIGITAL TECHNOLOGY SUPERCLUSTER

The Digital Technology Supercluster based in British Columbia is a flagship contributor that fosters projects developing networks driven by artificial intelligence (AI) and digital tools to build capacity for precision health in the province.

This federally-funded initiative aims to position Canada as a global leader in digital technology. With over $300 million in investment commitments, the Supercluster co-invests in technology development projects. It brings together over 500 businesses, post-secondary institutions, research organizations and not-for-profits.

Investments in the Supercluster's Precision Health Program fund data-driven innovations to improve disease prevention, early diagnosis, and personalized treatment:

- **The Dermatology Point-of-Care Intelligent Network** develops artificial intelligence-powered medical imaging to deliver faster care for diseases including skin cancer.
- **The Tailored Health – Pharmacogenetics project** allows medical professionals to tailor type and dose for commonly prescribed medications to patients using pharmacogenetic tools.
- **The Secure Health and Genomics Platform** aims to develop an effective system to collect, protect, secure, access, and use health data to improve the well-being of all Canadians.
- **The Reducing Opioid Use for Pain Management** project is an active monitoring system that enables physicians to improve pain management and proactively manage opioid prescriptions and their use in surgery patients.
- **The Personal Health Wallet** applies blockchain technology to personal health data to allow individuals full custody of their health data in a secure environment and to determine with whom they will share their health data.
- **The Intelligent Network for Point-of-Care Ultrasound** project uses ultrasound imaging to provide an early diagnosis of medical conditions including urgent heart and pregnancy conditions.

MetaOptima *is one of British Columbia's fastest growing digital health companies and is a flagship participant in the* **Dermatology Point-of-Care Intelligent Network** *supported by the Digital Technology Supercluster. MetaOptima's two mobile dermatology core products – MoleScope and DermEngine — offer faster, more affordable and accurate care to patients. Investors took notice and the company raised $8.6 million in funding through a Series A round in 2018.*

Talent Development

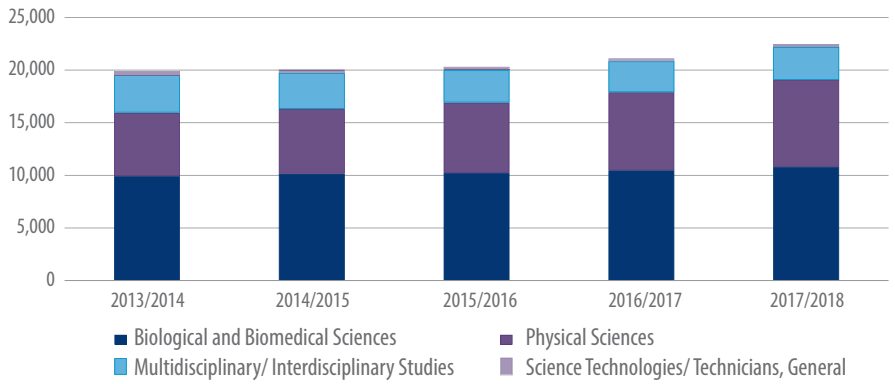
British Columbia's 25 public post-secondary institutions offer a range of health sciences and applied and natural sciences training programs in areas such as biotechnology, microbiology and immunology, molecular biology, genetics, and clinical genetics technology, behavioural neuroscience, and biomedical engineering and technology (see Appendix A: Sources and Methodology for Talent Development statistics, p.48).

POST-SECONDARY ENROLMENTS IN LIFE SCIENCES RELATED PROGRAMS

Students benefit from high-quality training offered at public post-secondary institutions across the province. The number of students enrolled in life sciences related Baccalaureate and graduate programs has grown 13% in recent years, from just under 20,000 in 2013/14, to almost 22,500 in 2017/18.

Biological and Biomedical Sciences programs had the largest proportion of enrolments in each of the five years reported.

Figure 15: ***Enrolments in Life Sciences Related Programs by Instructional Program type***

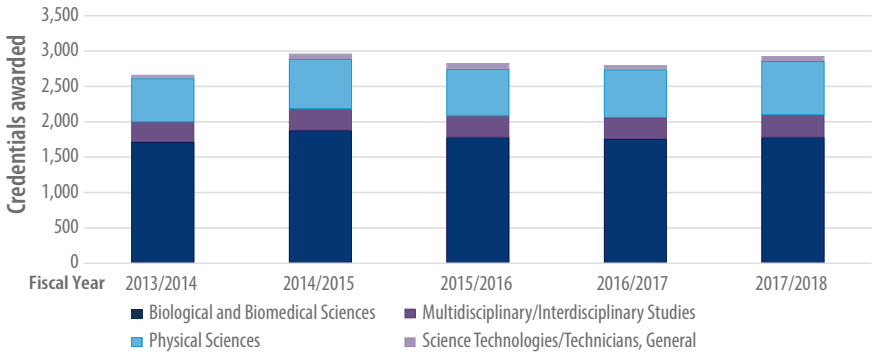


Source: Student Transitions Project, Fall 2018 submission, Ministry of Advanced Education, Skills and Training

CREDENTIALS AWARDED FOR LIFE SCIENCES RELATED PROGRAMS

The number of credentials awarded by British Columbia post-secondary institutions for life sciences related programs has fluctuated slightly around an average of 2,800 credentials over the five years reported, with Biological and Biomedical Sciences making up the largest proportion.

Figure 16: ***Credentials Awarded for Life Sciences Related Programs by Instructional Program Type***



Source: Student Transitions Project, Fall 2018 submission, Ministry of Advanced Education, Skills and Training

Mitacs **Internship Programs:** *Mitacs is a national, not-for-profit organization that co-funds graduate student internships to promote research and innovation across Canada by building linkages between academia and industry. Mitacs works with 70 universities, 6,000 companies, and is funded by both federal and provincial governments. The British Columbia Ministry of Advanced Education, Skills and Training has consistently funded Mitacs to support internships and innovation in the province. Mitacs has trained more than 33,000 student and postdoc participants over the past 20 years. Mitacs graduate interns typically work within industry settings – sometimes internationally – and apply their graduate expertise to solve R&D challenges, including in the life sciences and biotechnology sector.*

Key Industry and Government Players

British Columbia benefits from specialized biotechnology, pharmaceutical, medical device, diagnostic and digital health companies, a strong research capacity, and a growing digital approach to life sciences.

The life sciences sector is supported by industry organizations and accelerators, governmental organizations, economic development initiatives, universities and research hospitals, and other organizations that coordinate specific activities such as clinical trials.

This section presents the key organizations and recent initiatives available to the life sciences industry in British Columbia. It also presents several key companies and the provincial context within which they operate.

Industry associations and accelerators

Two British Columbia industry associations are key to the life sciences sector. Several provincial and global companies belong to both associations in order to benefit from their large combined networks, targeted services, and opportunities.

- **LifeSciences BC**[19] is an industry association that supports and represents the life sciences community of British Columbia through leadership, advocacy, and promotion. LifeSciences BC supports local, national and international partnerships, helps to facilitate investment, and offers networking opportunities for its members, global partners, investors and government representatives. LifeSciences BC works to ensure all segments of the sector, from academia and research, to biopharmaceuticals and medical technology, to digital health and medical devices, are developed in a comprehensive, complementary, and coordinated fashion. LifeSciences BC works collaboratively with provincial and federal government agencies, especially in the health and economic development domain, and represents the sector at key international events.

> ***LifeSciences BC*** *brings the community together to discuss issues that impact the life sciences sector, and hosts events such as the annual LifeSciences BC Awards that offers networking opportunities with national and international thought-leaders while showcasing and celebrating the key achievements of the life sciences community.*

- **The *BC Tech Association*** is a not-for-profit industry association founded in 1993 that represents the technology community of British Columbia. Originally predominantly focussed in the information, communication and digital areas, they now represent several life sciences companies and organizations because of the digital transformation of the life sciences sector. The BC Tech Association delivers several programs to accelerate industry growth, and hosts events that bring the community together.

19 LifeSciences BC (2019). *https://lifesciencesbc.ca/*

- **Accelerators**. The province has developed a network of incubators and accelerators that are either independent or supported by local governments, universities, or corporations, and are designed to support the commercialization process, including for life sciences companies. The services offered include networking opportunities, flexible office space and facilities, legal and consulting advice, access to mentorship, venture capital, and expertise for start-ups. A network of ten accelerators connected to Innovate BC[20] – British Columbia's innovation crown agency – is available to support companies across the province, including in the life sciences sector. Additionally, specific initiatives such as the Creative Destruction Lab-West exist for nascent life sciences ventures and topic-specific organizations such as Praxis (spinal cord injury products) contribute to commercialize discoveries in their area.

*The **Creative Destruction Lab (CDL)-West** is a university-based accelerator that offers mentorship from entrepreneurs and angel investors to selected early-stage companies. This includes intensive full-day mentorship sessions every eight weeks and capital-raising opportunity meetings. CDL-West's health and life sciences stream is tailored towards early-stage companies, but start-ups at all levels of maturity may be considered in such areas as biotechnology, bioinformatics, therapeutics, devices and diagnostics, and digital care and education. CDL-West graduate companies have become active growing companies in British Columbia. CDL-West is headquartered at the Sauder School of Business of the University of British Columbia.*

Provincial and Federal Governments

British Columbia's life sciences industry is supported by a variety of provincial and federal government organizations that help develop the conditions for economic growth in the province through several initiatives, services, programs and incentives. The provincial government and the federal government work hand in hand to foster a competitive environment for industry. Although these key players are not necessarily specialized in the life sciences sector, their services and programs are available to the sector. (See Appendix B for list of the main government programs).

- **The British Columbia *Ministry of Jobs, Economic Development and Competitiveness* (JEDC)** provides the long-term foundation for the economic development of the province. JEDC has responsibility for research and innovation, coordinating international collaborations, and supporting and facilitating the development of economic clusters.
- **The British Columbia *Ministry of Health* and the province's Health Authorities** support health research programs and collaborate with health research organizations. The Health Authorities lead research centres and integrate resulting innovation stemming into the health system.
- ***Innovate BC*** is the Provincial Crown agency responsible for innovation. Although not specialized in life sciences, their services and programs are available to life sciences companies. Innovate BC supports economic development and promotes British Columbia internationally as a preferred place to invest and do business. It offers funding, expertise and connections, helps entrepreneurs start companies, supports technology commercialization, and mentors companies.

20 Innovate BC. (2018). *https://innovatebc.ca/*

- ***Innovation, Science and Economic Development*** **(ISED) Canada** is the federal department that advances the conditions for investment in the country, fosters innovation, and builds a fair, efficient and competitive marketplace. ISED offers and oversees multiple programs that may benefit life sciences companies and research organizations.
- **The *Canadian Trade Commissioner Service* (TCS)** provides strategic market information, funding support, and market access solutions for Canadian companies looking to export, invest abroad, or develop international innovation and R&D partnerships. The TCS also assists foreign companies planning to invest in Canada or current investors seeking to expand their operations in Canada.
- ***Western Economic Diversification*** **(WD) Canada** promotes business development, innovation, and community development in Canada's western provinces. Local representatives facilitate connections and support specific projects. WD Canada also offers programs and resources for enterprises looking to start, grow, and expand through innovation.
- **The *National Research Council* (NRC) of Canada** provides advice, connections, and funding to help Canadian small and medium-sized businesses increase their innovation capacity and take ideas to market. Through its flagship Industrial Research Assistance Program, the NRC offers access to local industrial technology advisors with an extensive network of regional, national, and international partners that can provide access to customized support.

STEMCELL Technologies: *In 2018, the governments of Canada and British Columbia announced a joint $45 million funding agreement to help STEMCELL Technologies build a state-of-the-art advanced manufacturing facility. The funding agreement will accelerate the Vancouver company's rapidly scaling business of providing cutting-edge reagents and tools to support researchers around the world working in the cell therapy and regenerative medicine fields.*

With a presence in 11 countries, STEMCELL Technologies Inc. is the largest biotech company in Canada. STEMCELL develops cell cultures and accessory products for life sciences research. The company offers more than 2,000 products and employs more than 1,000 people mostly located in Vancouver.

STEMCELL products are designed and developed by PhD and MSc scientists to streamline research protocols, reduce experimental variability, and increase the accuracy of results. STEMCELL's team collaborates with academic partners to develop, produce and distribute products adapted to specific research fields.

STEMCELL partners on the first project of Canada's NextGen Advanced Manufacturing Supercluster. The project will "produce viral vectors to treat patients suffering from late-stage cancer and genetic disorders, including rare forms of leukemia and blindness".

Investment in British Columbia's Life Sciences Sector

British Columbia benefits from the large Canadian venture capital (VC) market. Between 2007 and 2017, VC investment in Canada measured as a share of GDP ranked constantly second-highest out of the G7 countries, trailing only the U.S.[21] VC investments have tripled in the country between 2014 and 2019, from $2.1 billion to $6.2 billion, with investments in life sciences companies coming second after those in IT companies.[22] Historically, VC for the life sciences sector in British Columbia has been on the rise. For example, in 2016, the life sciences sector attracted 41% of VC investments in Western Canada, its biggest share in the preceding 20 years, representing 42% of total VC investment in the province. By contrast, in the rest of Canada, life sciences made up only 15% of investment for the same time period.[23]

In 2019, British Columbia obtained the third largest share of total VC in Canada with $1.3 billion, closely behind Quebec ($1.6 billion). Of this, British Columbia's life sciences companies have raised record financing, with close to $700 million from only the top four deals,[24] including:

- **Zymeworks**, a clinical stage biopharmaceutical company developing multifunctional biotherapeutics, raised $261 million (public offering) for a market capitalization of $1.6 billion;
- **Aurinia**, a late-stage clinical biopharmaceutical company focused on advancing its voclosporin in multiple indications, announced a successful stage 3 trial and raised $250 million (public offering) for a market capitalization of $1.7 billion;
- **Sierra Oncology**, a late-stage drug development company, raised $103 million (public offering); and
- **Chinook Therapeutics Inc.** raised $65 million (Series A) to advance precision medicines for kidney diseases.

Additionally, in the first quarter of 2020:

- **Aspect Biosystems**, a company that develops 3D bioprinting of human tissues, raised U.S. $20 million (Series A);
- **Sierra Oncology** raised $103 million financing to convert to common share;
- **AbCellera** partnering with ***Invetx***, a pioneering animal health biopharmaceutical company, announced a $15 million Series A financing and founding collaborations with WuXi Biologics;
- **Xenon Pharmaceuticals Inc.**, a clinical stage biopharmaceutical company, announced the closing of its public offering, raising $60 million.

21 Najmi, A. (2019). The Determinants of Venture Capital Funding in G7 Countries. *https://ruor.uottawa.ca/bitstream/10393/39195/1/Abouzar%20Najmi.pdf*

22 Canada Venture Capital and Private Equity Association (2018 and 2019). Venture Capital Canadian Market Overview 2018 and 2019. *https://central.cvca.ca/wp-content/uploads/2019/05/CVCA_EN_Canada_Q4-2018_Final2.pdf*; and *https://central.cvca.ca/wp-content/uploads/2020/03/CVCA_EN_Canada_VC_2019_Final-Mar13.pdf*

23 Government of Canada – The State of Venture Capital in Western Canada (February 2020). *https://www.wd-deo.gc.ca/eng/19494.asp*. Western Canada includes British Columbia, Alberta, Saskatchewan and Manitoba.

24 T-net (December 2019). *https://tinyurl.com/y7yhxayc*

The provincial government launched the ***BC Tech Fund*** in 2016, a $100 million venture capital fund, that helps grow the tech sector and create jobs by investing in other funds and companies based in British Columbia. The BC Tech Fund is managed by Kensington Capital Partners, and has invested in several British Columbia companies and Venture Capital Funds, including four life sciences companies through underlying funds investments.

The British Columbia ***Small Venture Capital Tax Credit*** encourages investors to make equity capital investments in the province's small businesses in order to give them access to early-stage venture capital and help them develop and grow. There are currently over 80 life sciences companies registered for the program in the province, with representatives from all three life sciences industry groups.

The Genome BC ***Industry Innovation Program (I^2Fund)*** provides debt investment to support companies developing innovative life sciences technologies in British Columbia.

At the federal level, the Crown corporation ***Business Development Bank of Canada (BDC)*** also provides VC to Canadian life sciences firms and leverages risk capital.

Zymeworks *– Created in 2003, Zymeworks is a leader in antibody therapeutics. The company is publicly listed with a valuation of over US $1 billion and has over 260 employees in Canada and the U.S. Zymeworks' proprietary therapeutic platforms are validated by nine partnerships with biopharma companies. These platforms have enabled the development of therapeutic candidates, and late-stage trials are planned for two immune-oncology agents that have the potential to change the global standard of care for breast, gastric and other cancers. Zymeworks has advanced these two agents into clinical trials in Canada, the U.S., and South Korea. While evolving globally, Zymeworks' growth continues to be centred in Vancouver, home to 70% of its workforce.*

In June of 2019, Zymeworks completed a CAD $261M public equity financing, setting a new Canadian record for biotech capital raises.

AbCellera *– Founded in 2012, Abcellera develops antibody therapies and vaccines. The company has grown to over 60 employees and recently relocated to a new Vancouver-based 21,000 square foot building.*

AbCellera is creating a new global pandemic prevention platform for discovering antibodies for CAR-T cancer therapies, fibrosis and neurodegenerative disease. Its use of machine learning and data visualization accelerates discovery and helps advance early successes into preclinical development.

AbCellera's proprietary single-cell antibody screening platform has resulted in a technology capable of unlocking challenging biotech therapeutic programs to move them more quickly towards the clinic. In 2018, AbCellera received US$10 million in Series A financing and announced in 2019 a collaboration with Novartis to advance programs on up to ten targets. Over the past three years, AbCellera has completed over thirty antibody discovery programs, including with seven global pharmaceutical companies.

Aspect Biosystems *is a growing biotechnology company of approximately 30 employees pioneering microfluidic 3D bioprinting of human tissues for medical research, therapeutic discovery, and regenerative medicine. Aspect Biosystems' technology platform enables the creation of living human tissues with unprecedented control, flexibility, and precision. Aspect Biosystems' collaborations with the University of Victoria and the University of British Columbia received two Ignite awards from Innovate BC (2017 and 2019).*

Research: A strong asset of British Columbia

Life sciences research is a strong asset of British Columbia supported by key organizations. Research is conducted by the private sector or by post-secondary institutions and affiliated hospitals. All play a vital role in advancing or testing discoveries, in training the next generation of highly skilled personnel, and in transferring knowledge for clinical applications or commercialization. Researchers, clinicians and students collaborate with business and industry, community organizations and government agencies. These partnerships enrich the quality and relevance of the research, facilitate the transfer and commercialization of knowledge, and benefit patients.

Clinical trials

Canada and its research clinicians are globally recognized for major medical discoveries and innovations, and for a strong capacity to participate in cutting-edge research and development.[25] Thus, Canada has captured 4% of global clinical trials[26] and is considered within the top three locations globally to conduct clinical trials.[27] All leading multi-national pharmaceutical companies conduct a large portion of their clinical trials in Canada and have recently made significant investments in Canadian clinical trials because of the country's world class clinical trials environment,[28] compounded by its macroeconomic stability, world-leading higher education system, and publicly funded health care system. The federal government has supported Canada's competitiveness in clinical trials with several efforts over the past few years, including:

- The development of a national standard for ***Research Ethics Boards*** to improve efficiency.
- A pan-Canadian contract template[29] for phase II and phase III clinical trial agreements.
- The ***Canadian Clinical Trials Asset Map*** to market Canada in the global marketplace.
- The Canadian Clinical Trials Coordinating Centre to facilitate collaboration across Canada.

25 Council of Canadian Academies (April 2018). Competing in a global innovation economy: The current state of R&D in Canada *http://new-report.scienceadvice.ca/*

26 Government of Canada, Clinical trials environment in Canada. (October 2016). *https://www.ic.gc.ca/eic/site/lsg-pdsv.nsf/eng/h_hn01774.html* (Accessed January 2020).

27 KPMG, Competitive Alternatives (2016). *http://mmkconsulting.com/compalts/reports/compalt2016_report_vol1_en.pdf* (Accessed January 2020).

28 Government of Canada, Clinical trials environment in Canada. (October 2016). *https://www.ic.gc.ca/eic/site/lsg-pdsv.nsf/eng/h_hn01774.html* (Accessed January 2020).

29 The model Clinical Trials Agreement (mCTA)

British Columbia has resources to enable a strong clinical trials environment. There are over 100 sites available for clinical trials[30] throughout the province,[31] and the British Columbia Academic Health Sciences Network initiated by the British Columbia Ministry of Health offers support services for clinical trials, ethics, and patient-oriented research through its three units aimed at fostering collaboration, research, and excellence in care and education:

1. ***Clinical Trials BC*** advances British Columbia's development as a world-class destination for clinical trials across British Columbia's hospitals, research institutions and communities.
2. ***Research Ethics BC*** streamlines the ethics review and approval process in the province across all their partner institutions.
3. ***BC Support Unit*** is part of the national Strategy for Patient Oriented Research, and supports, streamlines and increases patient-oriented research throughout British Columbia.

British Columbia conducts a high proportion of all the trials conducted in Canada and the research revenue of the University of British Columbia reached over $38 million for clinical trials in 2018/19.[32] A point-in-time analysis[33] conducted in June of 2019 shows that:

- 1,238 active clinical trials were registered in British Columbia of which 35% were registered as oncology trials, 10% as cardiology trials, and 14% examining medical devices.
- 37% of the active clinical trials in British Columbia were undergoing Phase III reviews.
- 22% (711) of the 3,287 Canadian trials that were actively enrolling (recruiting) patients were listed in British Columbia.
- 60% of the active trials were industry funded, while 33% were university or grant funded. The National Institutes of Health (U.S.) was responsible for funding 9% of the clinical trials in the province.[34]

30 Canadian Clinical Trials Coordination Centre, BC ShowCase (January 2020). *http://bc.cctam.ca/*

31 WelcomeBC, Multicultural B.C. (January 2020). *https://www.welcomebc.ca/Choose-B-C/Explore-British-Columbia/Multicultural-B-C*

32 Source: *https://research.ubc.ca/research-excellence/research-funding-statistics/201819*

33 Clinical Trials BC, based on data from ClinicalTrials.gov, the reference database of privately and publicly funded clinical studies conducted around the world.

34 Clinical Trials BC, Monthly Metrics (June 2019).

Key research support organizations

MICHAEL SMITH FOUNDATION FOR HEALTH RESEARCH

The *Michael Smith Foundation for Health Research* (MSFHR) is British Columbia's health research funding agency created in 2001 to build capacity in the health research sector and support talent attraction and retention. Funded by the Province of British Columbia, MSFHR programs help develop research talent; partner to increase funding available to health researchers; support knowledge translation towards commercialization; and help respond to the health system priorities. The MSFHR has supported over 1,700 researchers and 120 research teams with contribution from the Province of British Columbia to advance new treatments and cures. In 2016, the Foundation launched a refreshed suite of eight targeted funding programs, developed on the basis of extensive consultations.

By providing more awards through working with partner organizations, the Michael Smith Foundation for Health Research leverages additional funds into the health research ecosystem of British Columbia.

GENOME BC

Genome BC is a not-for-profit organization created in 2000 that fosters genomics innovation. It funds genomics research, supports the development of genomic technology platforms, promotes knowledge transfer, and fosters entrepreneurship. By working collaboratively with government, academia and industry through a co-funding approach, Genome BC's goal is to be a catalyst for life sciences research and commercialization. Genome BC does not conduct research itself but supports genomic research with funds provided by the Province of British Columbia and facilitates matching funds for projects supported by federally funded organizations such as Genome Canada and Western Economic Diversification Canada. Genome BC has managed a combined portfolio of $1 billion in 390 research projects with a contribution from the Province of British Columbia. Outcomes include over $805 million in co-funding secured; 1,000 collaborations; and 660 patent applications submitted.

Genome BC endeavours to demonstrate the utility and application of genomics and encourages the adoption of genomics technology. They also support the investigation of societal issues such as the privacy of personal genetic data, the implications of gene editing, and public perceptions related to genomics. Genome BC is a trusted leader in British Columbia, and a catalyst for innovative solutions through the science of genomics.

Main sources of public funding for life sciences research in British Columbia:

- *The* **Michael Smith Foundation for Health Research** *(Provincial): Focus on health and clinical research.*
- **Genome BC** *(Provincial): Focus on genomics research.*
- **The BC Knowledge Development Fund** *(Provincial) and the* **Canada Foundation for Innovation** *(federal): Focus on co-funding capital equipment for research*
- **The Canadian Institutes of Health Research** *(federal): Canada's federal funding agency for health research. Focus on all types of health-related research.*

THE BC KNOWLEDGE DEVELOPMENT FUND AND THE CANADA FOUNDATION FOR INNOVATION

The *BC Knowledge Development Fund* (BCKDF) is the Province of British Columbia's primary capital investment in support of research infrastructure in the province. The BCKDF provides funding for British Columbia's public post-secondary institutions, research hospitals, and affiliated non-profit organizations. Investments are cost-shared by the federal Canada Foundation for Innovation and together the two programs have co-contributed over $720 million for the wet and dry lab equipment of over 600 life sciences research projects in such areas as urology, ophthalmology, pediatrics, nutrition, bio-chemistry, molecular biology, and plant and tree biology. Specific equipment may include sample preparation equipment, spectrometers, high-throughput screening devices, and super-resolution microscopes.

THE CANADIAN INSTITUTES OF HEALTH RESEARCH

The *Canadian Institutes of Health Research* (CIHR) is Canada's federal funding agency for health research. Composed of 13 Institutes each dedicated to one area, the CIHR collaborates with partners and researchers to support the discoveries and innovations that improve health and strengthen the health care system.

The CIHR has contributed over $1.3 billion to British Columbia research over a 10-year period (2009-2018), with over $150 million awarded in 2018 alone.[35]

ADMARE BIOINNOVATIONS

Headquartered in British Columbia, adMare BioInnovations is Canada's Global Life Sciences Venture, a single-stop destination that offers scientific, business, infrastructure and capital resources to existing life sciences companies, changing the landscape of the life sciences ecosystem. adMare sources the most therapeutically and commercially promising research from academic and biotech partners to create new companies of scale, providing specialized expertise and infrastructure to help existing companies scale up, and driving the growth of those companies into Canadian anchors by training the next generation of highly-qualified personnel.

adMare is a recent merger of the Vancouver-based Centre for Drug Research and Development, the NeoMed Institute (a leading R&D organization based in Montreal) and Accel-Rx (Canada's Health Sciences Accelerator), and benefits from a large modern research lab on the campus of the University of British Columbia.

*When **adMare's** team identifies promising leading technologies and platforms, they generate intellectual property and develop commercial strategies that form the foundation for building investable companies. adMare develops compelling business cases to secure private sector investors, grow companies, and take technologies to patients. The adMare Academy was created to offer training experiences to students, and the adMare Academy Executive Institute is supported by a $1 million contribution from Pfizer Canada.*

35 Source: CIHR Funding Decisions Database. *https://cihr-irsc.gc.ca/e/38021.html*

TRIUMF AND TRIUMF INNOVATIONS

TRIUMF is Canada's particle accelerator centre, located next to the University of British Columbia. TRIUMF's life sciences program includes research and production of isotopes for medical imaging, cancer treatment, and tracers for Parkinson's disease. TRIUMF recently announced its capacity to produce the rarest drug on Earth, actinium-225, an isotope with unique properties that scientists believe could eradicate cancer cells. TRIUMF Innovation is the commercialization arm of TRIUMF, linking cutting-edge science and technology to business opportunities. *TRIUMF Innovations* acts as a connector to the business world by providing market opportunities for physics-based technologies that emerge from the TRIUMF network.

***ARTMS* is a spin off company from TRIUMF** *and a leader in the development of technologies to produce the world's most-used diagnostic imaging isotope: technetium-99m. Tc-99m is used in over 80% of nuclear medicine imaging procedures and is vital to patient care in areas such as cardiology, oncology, and neurology.*

POPULATION DATA BC

Population Data (PopData) BC is a multi-university resource facilitating research on human health, well-being and development. PopData supports research access to individual-level, de-identified longitudinal data on British Columbia's 4.7 million residents. Datasets are linkable to each other and to external data sets, where approved by the data provider. Linkage of data facilitates advances in understanding the complex interplay of influences on human health, well-being and development. PopData is involved in several projects including: the British Columbia Provincial Overdose Cohort; the British Columbia Data Deliberation; the Data Innovation Program; and the Strategy for Patient Oriented Research (SPOR) Canadian data platform.

Academic Research

Image courtesy of Simon Fraser University

THE UNIVERSITY OF BRITISH COLUMBIA

The University of British Columbia (UBC) is one of the world's top 40 research universities, with over 60,000 students and over $650 million in research funding annually. UBC is home to some of Canada's strongest life sciences interdisciplinary and genomics hubs, with researchers in molecular genetics, genomics, forestry, bioproducts, biodiversity, bioengineering, personalized medicine, health data, and microbial research.

- **The *Life Sciences Institute* at UBC** is a flagship facility for life sciences research. Over 85 scientists and 600 trainees and staff conduct research, which has brought new, targeted drugs into clinical trials and onto the market.
- **The *Michael Smith Laboratories*** combines biology and technology to discover solutions to such issues as finding a pathogenic Escherichia coli vaccine to prevent its spread by cattle and developing human therapeutics. More than 300 researchers work at the facility.

- **UBC's *Djavad Mowafaghian Centre for Brain Health*** is Canada's largest integrated brain research and treatment facility. It is a training and research hub for neuroscience, neurology, psychiatry, and rehabilitation. The Centre's translational research provides patients with access to treatments for diseases such as multiple sclerosis, stroke, and neurodevelopmental disorders.
- UBC is affiliated with health authority research institutes, and partners with numerous national and international centres, including **TRIUMF**, and the **Nanomedicines Innovation Network**, which advances "smart" medicines to cure disease by delivering small molecule drugs specifically to disease sites.

UBC's Okanagan campus in Kelowna is one of the most rapidly expanding campuses in Canada, with over $25 million in annual research funding, more than 1,600 research projects underway, and strengths in population health and chronic disease prevention, especially in the areas of **spinal cord injury, behaviour change, bio-micro and nanotechnologies,** and in the **therapeutic benefits of cannabis.**

Innovation UBC provides support for translating research into new treatments, services, and products, and the **University-Industry Liaison Office** supports research partnerships and technology transfer. Over 100 spin-off companies formed around UBC life sciences technologies including Precision Nanosystems, AbCellera, and Sitka Biopharma.

Precision NanoSystems Inc. **(PNI) spun off from the University of British Columbia** *and now exports to hundreds of organizations worldwide — including 19 of the top 25 global pharmaceutical companies. The Vancouver-based company provides solutions for the development and manufacture of nanoparticle based precision and gene therapies for the treatment of cancer, infectious disease, rare disease and cardiometabolic disease. PNI's core technology includes its NanoAssemblr microfluidic platform for nanomedicine manufacture and its GenVoy nanoparticle delivery technology for gene therapy. These advanced therapeutics allow treatment of disease at its molecular root cause.*

PNI's nanomedicine development and manufacturing platform is at the heart of many of the leading gene therapies under development today in over 100 biopharmaceutical companies globally. Many of the drugs of the future are expected to be developed with this type of new technology.

UNIVERSITY OF VICTORIA

The University of Victoria (UVic) is one of the top-ranked comprehensive, research-intensive universities in Canada with signature research areas in mental health, Indigenous health, healthy aging, and translational medicine. UVic has over 21,000 students, more than $110 million in research revenue (2018/19), approximately 150 researchers working in the life sciences area, and several centres that provide the infrastructure to maximize its research strengths:

- **The *UVic-Genome BC Proteomics Centre*** provides technologies and services for translational proteomics research to academia and industry. It is the central hub of the Pan-Canadian Proteomics Centre.
- **The *Institute on Aging and Lifelong Health*** aims to improve the health and quality of life of older adults and to assist their caregivers, health care providers, and the government in meeting the challenges of an aging population.

- **The *Canadian Institute for Substance Use Research*** is a community-based network that studies substance use and addiction to promote health and reduce harm.
- **CanAssist** develops innovative technologies, programs, and services for people who experience physical or cognitive barriers.

UVic's **Research Partnerships and Knowledge Mobilization** unit connects faculty and students with external partners – including industry. The UVic-owned **Vancouver Island Technology Park** – the largest university technology transfer space in British Columbia – provides an environment where small firms can thrive because of the proximity of complementary companies, industry partners, mentors, support facilities, and investors. The Park generates $317 million in revenues and has created over 2,000 jobs.

SIMON FRASER UNIVERSITY

Simon Fraser University (SFU) has approximately 35,000 students and conducts research that expands its global impact, especially in computing and big data. SFU's annual research income reached $161 million in 2019.

- **Big Data Hub and Cedar Supercomputer.** SFU is renowned for big data research including in life sciences (bioinformatics, genomics, health sciences, neuroscience). SFU's big data facilities host *Cedar*, the most powerful academic supercomputer, serving over 13,000 Canadian researchers. With the new provincial Quantum Algorithm Institute and one of the top computer science departments in the country, SFU is well-positioned to serve the increasingly data-intensive life sciences research.
- **Bioinformatics and the computational analysis of genomic data** is a strong SFU research area in which researchers find new methods for the diagnosis, prevention, and treatment of disorders and infectious diseases through the application of algorithms and statistical analyses. Several faculty members have joint appointments at the Michael Smith Genome Sciences Centre.
- ***4D LABS*** is a core materials science research facility that offers customized R&D for researchers and industry, and transforms ideas into commercializable engineered materials and devices, including medical diagnostic tools such as portable and affordable biosensors.
- **ImageTech** is a medical imaging facility in Surrey Memorial Hospital providing unique insights into neurology. This is the only MRI+MEG facility in Western Canada.
- **eBrain Lab** brings together biomedical engineering, computer science and neuroscience to design interventions targeting youth mental health and addictions.
- **WearBioTech Centre.** This new centre for innovations in wearable biomedical technologies will open in 2020. It will develop biomedical monitoring sensors, garments for assisting movement, and systems to harvest energy to power the new devices.

Image courtesy of Simon Fraser University

UNIVERSITY OF NORTHERN BRITISH COLUMBIA

The University of Northern British Columbia (UNBC) research pillars include Environment and Natural Resources, Community Development, Northern, Rural and Environmental Health, and First Nations and Indigenous Studies.

UNBC's *Health Research Institute* works with the Northern Health Authority and other partners to conduct biomedical research, facilitate its translation, and provide training for future health professionals in the north of the province. With the opening of the BC Cancer Agency – Centre for the North in 2012, new opportunities for research became possible through the engagement of northern patients and the development of novel technologies targeted at small or mobile treatment facilities.

UNBC is developing an **Innovation Strategy** to enhance connections between researchers, communities, businesses, industry, and governments. The university's strengths in knowledge translation stem from its community-driven partnerships.

BRITISH COLUMBIA INSTITUTE OF TECHNOLOGY

Located in Burnaby, the British Columbia Institute of Technology (BCIT) is one of the province's largest post-secondary institutions. It offers career credentials designed for the workplace to over 48,000 students annually.

BCIT hosts several niche research groups, such as the *Phytoanalytics Laboratory*, a Canadian leader in supporting the natural health product and agrifood sectors. The **Phytoanalytics Laboratory** is fully equipped for research and is home to a Bruker AVANCE III HD™ 400MHz Nuclear Magnetic Resonance spectrometer, the first certified Foodscreener in North America. This state-of-the-art lab allows testing of products, supports the development of new therapeutics, provides unique educational opportunities, and helps shape the regulation of natural health products in Canada. The Phytoanalytics Lab is closely linked to the priorities of regulating agencies, and is of interest with regard to medicinal plants, natural health products and the food industry.

In addition, BCIT's *MAKE+* is a multidisciplinary research group in the area of ergonomic assessment, health and industrial design. The MAKE+ sub-group **PART (Product and Process Applied Research Team)**, is a cornerstone of the medical device community, and it is the only academic product development group in Canada that meets the ISO 13485 requirements for a comprehensive quality management system for the design and manufacture of medical devices.

Research Institutes

British Columbia benefits from several large health research institutes affiliated with both academic institutions and the provincial health authorities. Each of these institutes includes multiple research centres of relevance to the life sciences sector. Three institutes are described below.

British Columbia's main health research institutes:

UBC researchers and other academic researchers work on campus facilities and at affiliated health authority research institutes across the province, including:

- *Providence Health Care Research Institute;*
- *Vancouver Coastal Health Research Institute;*
- *BC Children's Hospital Research Institute;*
- *BC Cancer Research (research arm of the BC Cancer Agency); and*
- *Women's Health Research Institute*

PROVIDENCE HEALTH CARE RESEARCH INSTITUTE

The *Providence Health Care Research Institute* (at St. Paul's Hospital) includes nine research centres with clinical, epidemiological and laboratory research expertise in the following fields: HIV/AIDS, health outcome evaluation, heart and lung disease, sexual health, substance use, organ failure, cardiovascular health, heart valve innovation, and Indigenous health. For example:

The *BC Centre for Excellence in HIV/AIDS* *is Canada's largest HIV/AIDS research, treatment and education facility. The rapid incorporation of research results into clinical practice ensures that patients receive a continually evolving standard of evidence-based care. The Centre distributes antiretroviral therapy to patients in British Columbia and monitors HIV-related outcomes as part of its mandate.*

The *Centre for Health Evaluation and Outcome Sciences* *(CHEOS) has become one of Canada's foremost health outcomes research organizations. CHEOS also provides a range of research support services to clinical investigators and researchers, including assistance with study design, statistics, health economics, and data management, for both health outcomes research and clinical trials. CHEOS oversees the Canadian HIV trials network.*

THE VANCOUVER COASTAL HEALTH RESEARCH INSTITUTE

The *Vancouver Coastal Health Research Institute* comprises more than 1,500 personnel engaged in several research programs and in **nine research centres**: The Vancouver Prostate Centre; the BC Centre on Substance Use (BCCSU); Centre for Clinical Epidemiology and Evaluation (C2E2); Centre for Heart and Lung Health; Centre for Hip Health and Mobility (CHHM); Djavad Mowafaghian Centre for Brain Health; Immunity and Infection Research Centre; International Collaboration On Repair Discoveries (ICORD); and, Ovarian Cancer Research (OVCARE). For example:

> **The Vancouver Prostate Centre** *combines a large patient clinic, a clinical trials facility, patient supportive care, and basic science research program dedicated to answering challenging questions of cancer biology and translating research discoveries into treatments. It is the largest program of its kind in Canada. The Vancouver Prostate Centre developed standards of care for prostate patients, such as the intermittent hormonal therapy that has become a global standard for prostate cancer treatment.*

BC CANCER RESEARCH

BC Cancer Research, part of the BC Cancer Agency, provides a comprehensive research program in collaboration with universities and regional health authorities. BC Cancer Research studies new or improved cancer treatments, ways to prevent and detect cancer, and supports clinical trials. Its Technology Development Office provides management of intellectual property to ensure that innovations are identified, protected and leveraged.

The **nine research departments** of BC Cancer Research include: Canada's Michael Smith Genome Sciences Centre; Cancer Control Research; Clinical Research and Trials; Experimental Therapeutics; Deeley Research Centre; Integrative Oncology; Lymphoid Cancer Research; Molecular Oncology; and, the Terry Fox Laboratory. For example:

> **Canada's Michael Smith Genome Sciences Centre (GSC)** *was established in 1999 and has contributed to further understanding of the molecular biology of health and disease and applying it to cancer treatments. The GSC has contributed to nearly 900 research projects, leading to new scientific knowledge and technical developments that have made precision medicine a reality, and has published over 1,300 original scientific articles. Since 2012, more than 1,000 patients have been enrolled in the world famous Personalized OncoGenomics clinical research program which has remodeled understanding of cancer biology.*

The firsts of Canada's Michael Smith Genome Sciences Centre

2003: *The GSC was first in the world to sequence the SARS coronavirus during the global outbreak, resulting in an accelerated vaccine initiative.*

2006: *The GSC was one of only four facilities in the world to receive a next generation sequencing machine (Solexa, now Illumina), which revolutionized genomics.*

2010: *The GSC made medical history by employing next generation sequencing to inform a treatment strategy for a cancer patient, resulting in the now world famous Personalized OncoGenomics (POG) clinical research program.*

2015: *GSC's ABySS de novo genome assembler won the International Bioinformatics Award from the Swiss Institute of Bioinformatics. ABySS was the first to assemble mammalian-scale genomes from the approximately 100 "letter" strings generated by DNA sequencing machines.*

http://www.bccancer.bc.ca/about/news-stories/stories/20-in-20-twenty-incredible-ways-the-bc-cancer-%E2%80%93-genome-sciences-centre-has-made-a-global-impact-over-the-last-twenty-years

Regional and International Activity

Life sciences businesses are discovering the advantages of British Columbia's open and diversified economy. British Columbia has one of North America's most competitive, flexible, and supportive business climates, with consistently favourable credit ratings, competitive taxes, a stable and well-regulated financial system and a fiscally responsible government.

Strong, collaborative international partnerships can be leveraged for the development of ideas, co-development of products for two markets, and easy access to partner markets.

The Cascadia Innovation Corridor

The *Cascadia Innovation Corridor* initiative links Vancouver, Seattle, and Portland to increase economic opportunity beyond what the cities and their surrounding regions could achieve independently. The Cascadia Innovation Corridor is advancing several projects in the region by accelerating the opportunities for public, private and social sector enterprises including in the life sciences sector. This includes: i) accelerating collaboration on regional public health issues (e.g., opioid crisis, aging populations); ii) enabling actionable data through the Cascadia Data Initiative to position the Corridor as a global centre for precision medicines, particularly related to cancer and aspects of global health; and iii) improving cross-border awareness for collaboration, regional partnerships, cross-border presence, and networks in the health and life sciences sector.

Regional Activity

The Province of British Columbia is party to a number of trade agreements making interprovincial trade a priority. The national *Canadian Free Trade Agreement* (CFTA) fosters improved inter-provincial trade by removing barriers and promoting free movement of goods, services and persons between provinces.

The *New West Partnership Trade Agreement* (NWPTA) between British Columbia, Alberta, Manitoba and Saskatchewan aims to create a barrier-free, inter-provincial market. This replaces the former Trade, Investment and Labour Mobility Agreement (TILMA).

International Markets and Free Trade Agreements

Canada has one of the world's most open trading economies, and businesses in British Columbia benefit from significant international *Free Trade Agreements (FTAs)* that include provisions that benefit the life sciences sector.

Canadian life sciences services providers are now on equal footing with competitors in European, Asian and North American markets with Canada's recent FTAs such as the Canada-European Union Comprehensive Economic and Trade Agreement

(CETA), Comprehensive and Progressive Agreement for Trans-Pacific Partnership (CPTPP) and the Canada United States Mexico Agreement (CUSMA).

As a result of these agreements, tariffs have been eliminated on Canadian goods produced by the life sciences sector such as pharmaceuticals and medical devices.

Suppliers, including Canadian medical device companies, benefit from expanded access to government procurement opportunities (e.g., expanded access to opportunities to supply hospitals, schools and universities in the European Union under CETA). Government procurement provisions cover a broad range of services that may be of interest to the life sciences sector including repair of machinery and equipment, and technical testing and analysis.

FTAs make it easier for short-term business visitors, intra-company transferees, investors, contract service suppliers, and independent professionals to conduct business and may include entry without the requirement of a work permit for 90 days in any six-month period for any of the following activities: meetings or consultations, research and design, marketing research, training seminars, trade fairs and exhibitions, sales, purchasing, aftersales or after-lease service, commercial transactions, translation and interpretation (some conditions apply).

FTAs include intellectual property protections for innovators that make Canada a more attractive environment for investment in life sciences.

British Columbia's ***strategic location*** on Canada's Pacific coast places the province at the commercial crossroads of Asia-Pacific and North America:

- Close to key markets and duty-free access to the U.S. and Mexico.
- The shortest sea route from Asia to North America.
- Connected to all major U.S. economic centres by secure, reliable road and rail networks.

The ***cost of doing business*** in British Columbia can be lower than in other locations in North America and gives companies in British Columbia a competitive edge based on:

- A low corporate income tax rate.
- Labour costs.
- Costs for power and facilities.

Several opportunities exist for British Columbia's life sciences sector that can be leveraged, drawing new investment from the province's priority markets including U.S., India, European Union, Japan, China and Korea.

Towards a Maturing British Columbia Life Sciences Sector

This report provides an overview of the economic contribution of the life sciences sector in British Columbia and outlines the main elements of its ecosystem. It is a descriptive report that will serve as a baseline and reference document for the future and is not intended to be exhaustive.

British Columbia hosts one of the largest life sciences sectors in Canada that benefits from a rich history rooted in life sciences research and product development and is supported by a highly skilled talent. Reinforcing the strengths of the provincial life sciences sector, British Columbia's digital sector contributes to the innovation and expansion of the province's biotech and health companies.

This report indicates that British Columbia's life sciences sector is growing and maturing, with areas of strength such as oncology, antibody therapy, and R&D services. Investor interest is strong, and opportunities for investment are on the rise with promising companies seeing unprecedented record investment in 2019 and the first quarter of 2020.

With demonstrated sustained growth in the face of changing economic landscapes, strong capacity for collaborative research, a highly skilled and growing life sciences workforce, and innovative biotechnology, medtech and digital companies that develop niche products and services of interest to global companies and investors, British Columbia's life sciences sector appears well adapted to the new business models and is well poised to continue its maturation.

The future of the sector will rely on a strong collaborative model, one that is rooted in innovation, supports growth, and fosters new ideas. While this report cannot fully reflect the many contributions towards the success of British Columbia's life sciences sector and its ecosystem, quality economic growth is a product of joint and sustained effort.

With special thanks to LifeSciences BC, Global Affairs Canada, and federal partners, the Government of British Columbia will continue to seek broader engagement with the life sciences stakeholder community toward future iterations of this document.

Appendix A: Sources and Methodology

Life Science Definition

For the purposes of this report, the following NAICS industries are included in the life sciences sector. Where all the 6-digit NAICS in a 4-digit aggregate industry are included, only the 4-digit industry code and description are listed. For those industries marked with an asterisk, only a portion of the industry was included. These codes have been used for the analysis regarding British Columbia and the comparisons to other provinces.

Table 4: ***Life Sciences Definition***

INDUSTRY GROUP	CANADA		UNITED STATES	
	NAICS	Industry Description	NAICS	Industry Description
Research, Testing and Medical Laboratories	541380	Testing laboratories	541380	Testing laboratories
	541710	Research and development in the physical, engineering and life sciences*	541713	Research and development in nanotechnology
			541714	Research and development in biology (except nanotechnology)
			541715	Research and development in the physical, engineering and life sciences (except nanotechnology and biotechnology)*
	6215	Medical and diagnostic laboratories	6215	Medical and diagnostic laboratories
Medical Devices and Equipment	339110	Medical equipment and supplies manufacturing	3391	Medical equipment and supplies manufacturing
	417930	Professional machinery, equipment and supplies merchant wholesalers*	423450	Medical, dental, and hospital equipment and supplies merchant wholesalers
Drugs and Pharmaceuticals	3254	Pharmaceutical and medicine manufacturing	3254	Pharmaceutical and medicine manufacturing
	414510	Pharmaceuticals and pharmacy supplies merchant wholesalers	424210	Drugs and druggists' sundries merchant wholesalers*
	6215	Medical and diagnostic laboratories	6215	Medical and diagnostic laboratories

Source: BC Stats

The definition used by BC Stats in this report is based on the one developed for Life Sciences Ontario by Deloitte Inc. to allow for consistency across Canada in the way the life sciences sector is examined. The only difference is that British Columbia's definition does not include the NAICS codes related to Agricultural feedstock and chemicals.[36] An equivalent U.S. definition was created using the Canadian definition as a basis. American codes differ from Canadian codes at the six-digit level, so the definitions may not be identical, but they should be close enough to allow for broad comparisons.

It is not possible to simply aggregate existing NAICS codes because, for some industries, only a portion is included in the life sciences sector; therefore, the life sciences share of those industries must be estimated. Also, given the scarcity of data at the most detailed level of NAICS, it is necessary to make some assumptions to disaggregate the data to the necessary level of detail.

36 Deloitte. (February 2019). *Accelerating Prosperity: The Life Sciences Sector in Ontario.*

Business Counts

Data for business counts are sourced from Statistics Canada's Canadian Business Counts (CBC) tables. Statistics Canada publishes data for these tables twice annually, with June and December reference dates. For the purposes of this report, the December reference period was used, so for example, business counts reported for 2018 are from the December 2018 table.

BC Stats receives an extract of the Business Register (BR), which is the source of the CBC tables, with all the micro-records for British Columbia. Business counts by sub-provincial region are derived from this extract. Note that Statistics Canada excludes some businesses from its count of businesses without employees (e.g., businesses with under $30,000 in annual revenue); however, the information the agency uses to make these exclusions is not included in the BR extract received by BC Stats. For this reason, counts of businesses without employees by sub-provincial region cannot be consistently calculated and are therefore not included in this report.

Employment and Wages

The primary source for information on employment and earnings is Statistics Canada's Survey of Employment, Payrolls and Hours (SEPH). Wages were mainly calculated using employment and average weekly earnings data. Unfortunately, SEPH data are available at only a 4-digit NAICS level of detail, whereas 6-digit detail is required for most of the industries in the life sciences sector. The Annual Survey of Manufactures (ASM) has wage and revenue information for the manufacturing industries broken down to the 6-digit level. For life sciences industries in the manufacturing sector, these data were used to split the 4-digit SEPH employment. For the service-sector industries, a different approach was needed to split the 4-digit employment figures into the 6-digit codes in the life sciences definition.

The one data source with complete 6-digit detail is business count data from the CBC tables. Data are also broken out by 21 employee size classes (i.e., 1-4, 5-9, 10-19, 20-29, etc.). To split 4-digit NAICS employment data into the necessary 6-digit detail, a ratio was calculated using employment estimates derived using the business count data. The estimates were calculated by taking the count for a size class times 60 percent of the lower bound plus the count times 40 percent of the upper bound and summing over all the employee classes. The 60/40 split was used instead of 50/50 as experimentation showed that using 50/50 yielded employment estimates that far exceeded actual employment figures.

To illustrate, if a particular NAICS had 20 employees in the 1 to 4 employee class, the calculation would be $1*20*0.6 + 4*20*0.4 = 12 + 32 = 44$. This would be added to the number calculated to each of the other size classes to get a total employment estimate for the industry.

Estimates were calculated for both the 6 and 4-digit codes, then the ratio of the 6-digit over the 4-digit estimate was applied to the 4-digit employment figure from SEPH to estimate employment for the 6-digit NAICS.

In some cases, the SEPH data were suppressed by Statistics Canada for some years, either due to confidentiality or data quality concerns. For these situations, the data were estimated using a variety of methods depending on what other information was available. For instance, where some years of data for a couple of provinces were suppressed, but data for Canada and most other provinces were available, the gaps were filled by applying the growth rate of the residual of Canada minus the sum of the provinces for which data exists to the available data from the provinces with missing data.

Wages for 6-digit industries were calculated using the employment estimates for that industry and the average weekly earnings for the appropriate 4-digit NAICS. In some cases, for the manufacturing sector, average weekly earnings from the ASM were used to calculate wages.

Revenues

Revenues for industries in the manufacturing sector (Medical Equipment and Supplies Manufacturing; Pharmaceutical and Medicine Manufacturing – see Table 4) were calculated using data from the ASM.

For the wholesaling industries, data from Statistics Canada's Annual Wholesale Trade Survey were used. For NAICS 541380 Testing Laboratories, the only viable source of revenue data is from the Financial Performance Indicators produced by the federal government. These data do not provide a complete picture of revenue; however, it is the only source available. As a result, revenues calculated for this specific industry may be underestimated to some extent. For the remaining service-sector industries, gross output figures from Statistics Canada table 36-10-0488-01 were used as an estimate of revenue.

Where data were suppressed due to confidentiality or data quality concerns, gaps were filled using a variety of methods such as growth of wages or residual growth rates as described above. Where no data existed for the 6-digit industry, data for a higher aggregation industry were split using the business count employment estimate methodology described earlier.

Gross Domestic Product

The source for gross domestic product (GDP) data is Statistics Canada's Economic Accounts, specifically tables 36-10-0401-01, 36-10-0402-01 and 36-10-0434-01. Similar to SEPH data, GDP data are only available at the 4-digit NAICS level from these tables. For current dollar estimates, the 6-digit NAICS were split from the higher aggregations using ratios of revenue. Since current dollar data are available only to 2015, they had to first be grown forward using the growth of constant dollar data inflated using an index calculated from average weekly earnings.

Once the current dollar figures were estimated at the 6-digit level, the constant dollar figures were calculated using the current dollar values divided by the appropriate 4-digit NAICS index, which was the ratio of current over constant dollar values. A chained value was then calculated for the total life sciences sector and each of the industry groups included in this report.

International and Interprovincial Trade

For trade in goods, the U.S. Bureau of the Census' advanced technology products categories of biotechnology goods and life sciences goods were used to define trade in life sciences goods. The list of American codes used to define those two categories was matched against the equivalent Canadian codes to develop data for Canada and the provinces. Data is sourced from the customs-based export and import data produced by Statistics Canada. As imports by province of consumption are not available, an estimate of British Columbia-consumed imports was derived using the consumption of Canadian imports of those commodities by the provincial economy and applying this ratio to total Canadian imports.

The source for **trade in services** data is primarily Statistics Canada's Supply-Use tables from table 36-10-0478-01. The list of "products" included in the calculation of life sciences trade in services is as follows:

- Architectural, engineering and related services* (portion only)
- Research and development services* (selected portion only)
- Medical laboratory diagnostic and testing services

Only a portion of trade in those products marked with an asterisk is included. For those industries, the life sciences portion was calculated by applying the life sciences share of revenue in the appropriate industry (testing laboratories; and research and development in the physical, engineering and life sciences, respectively).

The latest available year of data from the Supply-Use tables is 2016, so values had to be grown to 2018. For British Columbia, the industry shares of each trade type (international exports, international imports, re-exports, interprovincial exports, interprovincial imports) were calculated from the Supply-Use tables and those shares were applied to gross output data, then the growth rates of the resulting figures were applied to the trade by product. While BC Stats has access to current gross output estimates for British Columbia, access to data for other provinces and national-level data is limited to what is publicly available. That information does not go past 2016, so a different method had to be used to grow provincial and Canadian figures. For Canada, the growth of international transactions in commercial services from table 36-10-0006-01 was used. The other provinces were grown using the growth of the residual of Canada minus British Columbia.

United States Data

U.S. employment and wage data are sourced from the US Bureau of Labor Statistics Quarterly Census of Employment and Wages.

Revenue data for the manufacturing industries are sourced from the Annual Survey of Manufacturing and the Economic Census for 2007, 2012 and 2017. The Wholesale Trade Survey is the source for revenues in the wholesale industries. The Service Annual Survey and the Economic Census are the sources for revenue data for the other service industries.

GDP data are sourced from the US Bureau of Economic Analysis. Data are not available at the 6-digit level so higher level NAICS aggregations had to be split. For the manufacturing industries, value-added data from the Annual Survey of Manufacturing was used to do this. The wholesale industries were split using revenue shares and the other service sector industries were split using gross output.

Note that GDP for the United States is calculated only in current dollars as the information needed to calculate a chained dollar figure is not readily available.

The US Bureau of the Census is the source for trade in goods. As with the Canadian data, the advanced technology products categories of biotechnology goods and life sciences goods were used to define trade in goods in the life sciences sector.

For trade in services, data was sourced from the US Bureau of Economic Analysis. The list of "products" included in the calculation of life sciences trade is as follows:

- Architectural and engineering services
- Research and development services

For both, only a portion of trade is included. The life sciences portion was calculated by applying the life sciences share of revenue in the appropriate industry (testing laboratories; and research and development in the physical, engineering and life sciences, respectively). Unfortunately, the U.S. data are not detailed enough to split out medical laboratory diagnostic and testing services, such that the estimate is not entirely consistent with the Canadian figures and should be considered somewhat of an underestimate.

Calculating the Life Sciences Portion

There are two industries in the Canadian definition and three in the United States definition for which only a portion of the overall industry can truly be considered life sciences. For these industries, it was necessary to develop ratios to split the life sciences portion out of the industry total.

The two industries for which ratios were needed to split the Canadian data are NAICS 417930 Professional machinery, equipment and supplies merchant wholesalers and NAICS 541710 Research and development in the physical, engineering and life sciences. To calculate a ratio, data from Dun & Bradstreet's business list database was used. Even though the data are for Canadian companies, Dun & Bradstreet codes their data using American NAICS codes. Since the relevant U.S. NAICS code (423450) is all in the life sciences sector, Dun & Bradstreet were able to provide a simple count of that code and the larger 4-digit aggregation of 4234, which is equivalent to the Canadian 4-digit code 4179. The ratio of the counts of 423450 over 4234 was used to split the data. The data is available by province such that province-specific ratios could be calculated; however, the same ratios had to be used for each year as a time series is not available.

The ratios developed were used to split business count, employment and revenue figures, with the assumption that the ratios would be similar for each of these indicators. This was a necessary assumption given the scarcity of data to be used to calculate these ratios.

For NAICS 541710, a sample from the Dun & Bradstreet data was extracted and for each company in the list, it was determined through an online search whether or not the business should be considered to be included in the life science sector and the ratio was calculated by dividing those in life sciences over the total for the industry. The data extract had estimates of employment and revenue, such that separate ratios for business counts, employment and revenue could be calculated.

Once again, although province-specific ratios could be calculated, the same ratios had to be used for each year.

The two American industries for which ratios had to be determined were NAICS 424210 Drugs and Druggists' Sundries Merchant Wholesalers, and NAICS 541715 Research and Development in the Physical, Engineering, and Life Sciences (except Nanotechnology and Biotechnology). For the first industry, the Canadian industry has a more detailed breakout, such that a ratio could be calculated using the Canadian life sciences industry over the 4-digit aggregate. Given that no U.S. data could be found to calculate the ratios, this is what was used to split out the wholesale industry code. For NAICS 541715, the Economic Census has data at a 7-digit level where the life sciences sector is split from the rest of the industry. This information was used to calculate the ratio used to split the industry.

Methodology for Talent Development statistics

Talent development statistics are sourced from the British Columbia Ministry of Advanced Education, Skills and Training (AEST). The Ministry gathers student and institutional data to help with policy development, improve program delivery, and ensure student success. AEST provided enrolment and credentials awarded data (source: Student Transitions Project) for life sciences related programs offered at British Columbia's public post-secondary institutions.

- The data provided include enrolments and credentials for both human health and non-human life sciences programs.
- Data include both domestic and international students and exclude offshore students.
- In any given year, some students may be enrolled in more than one program; therefore, the sum of the program headcounts may include some students more than once.
- Data are restated annually to maintain accuracy and reflect institutional updates. Each number has been rounded to the nearest five; the effects of rounding may result in different reports not matching exactly.
- The Programs are as identified by the Classification of Instructional Programs (CIP) grouping of ***Physical and Life Sciences*** programs established by Statistics Canada. Note that the grouping includes only a sub-set of CIP codes within the 2-digit CIP 30 (Multidisciplinary/Interdisciplinary Studies).

Appendix B: Enabling Programs

Several provincial and federal governmental programs exist to promote innovation in British Columbia. Most of these programs support innovation across all sectors, but some are more specific to life sciences. The following list is not exhaustive but presents several of the main programs and resources available in British Columbia.

Innovation support and funding programs

The program ownership is mentioned prior to the program name: Innovate BC (British Columbia Crown Agency); JEDC: British Columbia Ministry of Jobs, Economic Development and Competitiveness; WD: Western Economic Diversification (Government of Canada); ISED: Innovation, Science and Economic Development Canada (Government of Canada); GAC: Global Affairs Canada (Government of Canada)

FEDERAL CONCIERGE SERVICE

A comprehensive list of 239 programs available in British Columbia for life sciences companies (non-exclusively), in support of funding, loans and capital investments, tax credits, wage subsidies and interns, expert advice, and partnering and collaboration. The federal programs highlighted in this table are also on the Concierge list. *https://innovation.ised-isde.canada.ca/innovation/s/list-liste?language=en_CA&token=a0B5W0000009xrkUAA*

INNOVATE BC – VENTURE ACCELERATION PROGRAM (VAP)

Supported by the 10 accelerators of the BC Acceleration Network, the VAP is delivered by a team of executives in residence who mentor tech entrepreneurs and help them define their business model based on a proven methodology and set of best practices for growing technology companies.

The 10 accelerators of the BC Acceleration Network include: VIATEC (Victoria, Vancouver Island); Innovation Island (Nanaimo, Vancouver island); entrepreneurship@ UBC (Vancouver); Foresight Cleantech Accelerator Centre (Burnaby); New Ventures BC (Vancouver); VentureLabs (Vancouver); Accelerate Okanagan (Kelowna); Kootenay Association for Science & Technology (Rossland); Kamloops Innovation (Kamloops); Innovation Central Society (Prince George) *https://innovatebc.ca/what-we-offer/connect-with-experts/venture-acceleration-program/*

INNOVATE BC – IGNITE PROGRAM

Ignite provides up to $300,000 in matching funds for innovation projects in the areas of natural resources, applied science, and engineering (e.g., medical technology). Project teams must be British Columbia-based and include an academic member and an industry partner. *https://innovatebc.ca/what-we-offer/get-funding/ignite/*

INNOVATE BC – NEW VENTURES BC COMPETITION

Annual business technology competition that awards $275,000 (ranging from $10,000 – $110,000 per winning company) in capital and in-kind business services to the most promising start-ups. The Competition provides British Columbian entrepreneurs with the skills and expertise to grow a start-up through a 10-week business seminar and networking series. During the competition process, start-ups benefit from mentorship, guidance, and support from angel investors and noted local entrepreneurs. *https://www.newventuresbc.com/the-competition/*

JEDC – TRADE AND INVEST BRITISH COLUMBIA

Trade and Invest British Columbia works with international enterprises to help them invest in the province. They also support export-ready British Columbia companies with strategic advice and an international business network, and link international buyers with British Columbian suppliers. *https://www.britishcolumbia.ca/*

ISED – STRATEGIC INNOVATION FUND (SIF)

Innovation, Science and Economic Development Canada (ISED) leads the Strategic Innovation Fund to spur innovation for a better Canada by providing funding for large projects (over $10 million in requested contribution). The program has five streams, each with its own precise objective:

- Stream 1: Encourage R&D that will accelerate technology transfer and commercialization of innovative products, processes and services;
- Stream 2: Facilitate the growth and expansion of firms in Canada;
- Stream 3: Attract and retain large-scale investments to Canada;
- Stream 4: Advance industrial research, development and technology demonstration through collaboration between the private sector, researchers and non-profit organizations;

and

- Stream 5: Support large-scale, national innovation ecosystems through high-impact collaborations across Canada. *https://www.ic.gc.ca/eic/site/125.nsf/eng/home*

ISED – INNOVATIVE SOLUTIONS CANADA (CHALLENGE-BASED PROGRAM)

Innovative Solutions Canada helps Canadian innovators by funding R&D and testing prototypes in real-life settings. As the single largest purchaser of Canadian goods and services, the Government of Canada has a unique opportunity to support the growth of Canadian small business innovators and entrepreneurs. This program offers opportunities to solve Government of Canada's challenges: $150,000 to support development of proof of concept for selected companies; up-to $1 million for selected proof-of-concepts to be developed as prototypes; Government of Canada to be the first buyer if the developed innovation solves the Government's challenge. *https://www.ic.gc.ca/eic/site/101.nsf/eng/home*

WD – BUSINESS SCALE-UP & PRODUCTIVITY

The Business Scale-up and Productivity program streams provide repayable, interest-free funding for businesses at various stages of development, including firms with high growth potential, to accelerate the growth and scale-up, improve productivity, and increase competitiveness in both domestic and global markets. *https://www.wd-deo.gc.ca/eng/19762.asp*

WD – REGIONAL INNOVATION ECOSYSTEMS

The Regional Innovation Ecosystems program stream aims to create, grow and nurture inclusive regional ecosystems that support business needs throughout the innovation continuum, and foster an entrepreneurial environment conducive to innovation, growth and competitiveness. *https://www.wd-deo.gc.ca/eng/19775.asp*

GAC – CANEXPORT INNOVATION

Program designed to promote and enhance Canada's international innovation efforts. The program supports researchers who aim to commercialize technology by pursuing collaborative international research and development (R&D) opportunities through partnerships with key players in foreign markets. Maximum of $75,000 per approved project. *https://www.tradecommissioner.gc.ca/trade_commissioners-delegues_commerciaux/funding-financement/canexport/innovation/index.aspx?lang=eng*

GAC – CANEXPORT SMES

Provides direct financial assistance to SMEs registered in Canada to help them develop new export opportunities and markets, especially high-growth emerging markets. Up to $75,000 in funding per business to cover up to 75% of international market development activities. *https://www.tradecommissioner.gc.ca/trade_commissioners-delegues_commerciaux/funding-financement/canexport/sme-pme/index.aspx?lang=eng*

GAC – CANEXPORTS COMMUNITY INVESTMENTS

Support to Canadian communities seeking to improve their capacity to attract, retain and expand FDI (international businesses establishing or expanding operations) in order to create jobs for Canadians, support innovation and increase exports. Between $3,000 to $500,000 per community to attract FDI up to 50% of costs. *https://www.tradecommissioner.gc.ca/trade_commissioners-delegues_commerciaux/index.aspx?lang=eng*

GAC – TRADE COMMISSIONER SERVICES

As part of Global Affairs Canada, the Canadian Trade Commissioner Service helps Canadian companies and organizations succeed globally. The Canadian Trade Commissioner Service has trade offices across Canada and in 161 offices around the world. It can provide Canadian businesses with on-the-ground intelligence, qualified contacts, partnership opportunities and practical advice on foreign markets to help companies make better, more timely and cost-effective decisions in order to achieve their goals abroad. *https://www.tradecommissioner.gc.ca/trade_commissioners-delegues_commerciaux/index.aspx?lang=eng*

GAC – GRAND CHALLENGES CANADA

Grand Challenges Canada is dedicated to supporting bold ideas with big impact. The program funds innovators in low and middle-income countries, and Canada, that integrate science and technology, social and business innovation, including in global health. *http://www.grandchallenges.ca/grand-challenges/*

GAC – IMPORT SERVICES

Import services are coordinated via the Canadian Border Services Agency, Canadian Food Inspection Agency and Innovation, Science and Economic Development Canada. *https://www.canada.ca/en/services/business/trade/import.html*

NATIONAL RESEARCH COUNCIL – INDUSTRIAL RESEARCH ASSISTANCE PROGRAM (IRAP)

The National Research Council of Canada Industrial Research Assistance Program (NRC IRAP) is Canada's leading innovation assistance program helping small and medium-sized businesses build innovation capacity and take ideas to market through financial assistance, advisory services, and connections to business and R&D expertise in Canada. *https://nrc.canada.ca/en/support-technology-innovation*

ISED – INTELLECTUAL PROPERTY STRATEGY

Over the next five years, the Government of Canada will ensure that Canadian businesses, creators, entrepreneurs and innovators have access to the best possible IP resources through IP awareness, education and advice; strategic IP tools for growth; and IP legislation. *https://www.ic.gc.ca/eic/site/108.nsf/eng/home*

Labour and Training Programs

INNOVATE BC – TECH CO-OP GRANT (TRAINING)

Grants to tech employers to support the hiring and training of undergrad co-op students. The program offers up to $2,700 per 4-month co-op term, and up to $10,800 annually. The BC Tech Co-op Grants Program is delivered in close collaboration with co-op departments at British Columbia post-secondary institutions. *https://innovatebc.ca/what-we-offer/get-funding/co-op-hiring-grant/*

INNOVATE BC – INNOVATOR SKILLS INITIATIVE (TRAINING)

Innovate BC's Innovator Skills Initiative (ISI) is delivered by New Ventures BC to help tech entrepreneurs hire and train students with entrepreneurship skills. Vouchers with values ranging from $1,000 to $5,000 are offered to tech companies hiring a post-secondary student in a role that will provide the student with entrepreneurial and/or business skills. The ISI offers up to $10,000 a year to all approved companies across the province. *https://www.newventuresbc.com/accelerate/isi/*

BC PROVINCIAL NOMINEE PROGRAM (LABOUR/IMMIGRATION)

The BC Provincial Nominee Program offers a series of sub-programs strategically designed to attract immigrants in areas which will benefit the province. This program helps recruit the highly-skilled foreign workers, entrepreneurs, and investors to the province. *https://www.welcomebc.ca/Immigrate-to-B-C/B-C-Provincial-Nominee-Program*

MITACS ACCELERATE (GRAD-STUDENTS)

This program provides graduate students and postdoctoral fellows with four to six-month internships at a company, under the guidance of a professor. Mitacs funds 50% ($7,500 per four-month period) of the internship with the employer funding the remainder.

MITACS ELEVATE (POST-DOCTORAL FELLOWS)

This postdoctoral fellowship program provides a 2-year foundation of research, business, entrepreneurship and scientific management skills to recent PhD graduates. Mitacs shares the internship costs.

MITACS GLOBALINK (INTERNATIONAL)

This program is composed of four sub-programs, which create opportunities for international students to conduct research in Canada and for Canadian students to conduct research in other partner countries.

MITACS ENTREPRENEUR INTERNATIONAL (START-UPS)

This program offers travel grants to Canadian start-ups housed in university-linked incubators. The matching $5,000 grant enables start-ups to connect with international incubators to explore new business development opportunities in global markets.

Tax incentives

SCIENTIFIC RESEARCH AND EXPERIMENTAL DEVELOPMENT (SR&ED – PROVINCIAL AND FEDERAL)

Both the federal and provincial governments offer research and development tax credits to support innovation.

- The federal portion of the SR&ED tax credit program allows Canadian-controlled private corporations to earn a refundable tax credit on eligible expenses or investments (35% up to a threshold of $3 million – 15% beyond this amount or for other corporations);
- The British Columbia SR&ED tax credit is administered by the Canada Revenue Agency and offers a refundable tax credit of 10% on eligible expenses or investments. *https://www.canada.ca/en/revenue-agency/services/scientific-research-experimental-development-tax-incentive-program.html* *https://www2.gov.bc.ca/gov/content/taxes/income-taxes/corporate/credits/scientific-research-development*

SMALL BUSINESS VENTURE CAPITAL TAX CREDIT (PROVINCIAL)

The Small Business Venture Capital Tax Credit is designed to encourage investors to make equity capital investments in British Columbia small businesses developing proprietary technology by providing a refundable tax credit to provincially-based investors equalling 30 per cent of their investment. *https://www2.gov.bc.ca/gov/content/taxes/income-taxes/corporate/credits/venture-capital*

Equity Funds (publicly funded)

ISED – VENTURE CAPITAL CATALYST INITIATIVE

The Initiative allocates capital to two streams:

- Stream 1 allocates a total of $350 million to large private sector-led funds-of-funds that seek to maximize returns through diversified investments, support skilled fund managers, and attract substantial private sector capital. The funds-of-funds mainly invest their capital in venture capital funds that fund investment in innovative companies in ICT, clean technology, health science, and other technology sectors.
- Stream 2 allocates $50 million for alternative models that that will make a significant impact on Canada's Venture Capital ecosystem by investing in areas that would not otherwise be addressed by large funds-of-funds.

BC RENAISSANCE CAPITAL FUND

The BC Renaissance Capital Fund is a wholly-owned subsidiary of the BC Immigrant Investment Fund, a crown corporation that makes venture capital investments in British Columbia's technology sector including life sciences. The BC Renaissance Capital Fund invests in venture capital funds as a limited partner and has two portfolios, both managed by Kensington Capital Partners. Portfolio 1 includes investments made in nine funds managed by eight fund managers. Portfolio 2, BC Tech Fund, actively invests in British Columbia based venture capital funds and co-invests in British Columbia-based companies.

BC TECH FUND (FUNDED BY THE PROVINCE OF BRITISH COLUMBIA)

This $100 million investment from the British Columbia government targets British Columbia's technology sector, including life sciences, invests in multiple venture capital funds based in the Province and co-invests with other venture capital fund partners. Over the lifetime of the agreement, the BC Tech Fund investments in British Columbia companies will help those businesses create high-paying jobs for British Columbians and substantially increase the province's technology footprint. The BC Tech Fund is focused primarily on investments at the Series A stage and is being managed by Kensington Capital Partners on behalf of the Province.

BUSINESS DEVELOPMENT BANK OF CANADA (BDC) CAPITAL

Founded in 1944, the Business Development Bank of Canada is a federal development bank structured as a Crown corporation wholly owned by the Government of Canada. Its mandate is to help create and develop Canadian businesses through financing, growth and transition capital, venture capital and advisory services, with a focus on small- and medium-sized enterprises. The Canada Small Business Financing Program makes it easier for small businesses to get loans from financial institutions by sharing the risk with lenders.

Scientific Research Funding (main sources of public funding)

MICHAEL SMITH FOUNDATION FOR HEALTH RESEARCH (PROVINCIAL)

British Columbia's health research funding agency created in 2001. Programs include:

Individual funding programs

- Health Professional-Investigator Program: For health professionals to develop and advance research to bring evidence into practice within the health system.
- Health Policy Fellowship Program / Health System Impact Fellowship: Connects post-doctoral health researchers with policy decision-makers to promote evidence-informed policy.
- Innovation to Commercialization (I2C) Program: Supports researchers to advance their discoveries towards practical application.
- Research Trainee Program: Supports health researchers in the training phase of their research career.
- Scholar Program: For early career researchers, to train the next generation of scientists and develop world-leading research programs.

Team funding programs

- Convening & Collaborating Program: Supports teams of researchers and users as they co-develop research aligned with British Columbia's health system priorities.

- Implementation Science Team Program: Supports teams to plan, conduct, and study the implementation of proven health-related interventions.
- Reach Program: Supports teams of researchers and users to disseminate their evidence to facilitate uptake impact on health and care.

BC KNOWLEDGE DEVELOPMENT FUND (PROVINCIAL – RESEARCH INFRASTRUCTURE)

The British Columbia Knowledge Development Fund (BCKDF) is the provincial government's primary investment in support of capital research infrastructure in the province's public post-secondary institutions, affiliated hospitals and research institutions. BCKDF shares project funding with other funding partners. Typically:

- The BCKDF funds up to 40 percent of total eligible project costs;
- The Canada Foundation for Innovation funds up to 40 percent of total eligible project costs; and
- Other funding partners (e.g., private partners, research institutions) provide cash or in-kind funding for the remainder of the total eligible project costs. BCKDF intakes align with the intakes of the Canada Foundation for Innovation.

CANADA FOUNDATION FOR INNOVATION (FEDERAL – RESEARCH INFRASTRUCTURE)

The Canada Foundation for Innovation is an independent not-for-profit organization that invests in research facilities and equipment in Canada's universities, colleges, research hospitals, and non-profit research institutions. Costs are typically shared with Provinces (BCKDF for the Province of British Columbia). The main ongoing programs are:

- The John R. Evans Leaders Fund: Three intakes per year – For small equipment (up to $2 million total project cost).
- Innovation Fund: One intake every two to three years – For major equipment projects.
- College-Industry Innovation Fund: For collaboration projects between colleges and industry.
- Major Science Initiatives Fund (operation funding for major Canadian scientific facilities and initiatives).

GENOME BC (PROVINCIAL – GENOMIC RESEARCH AND TRANSLATION)

Genome BC is a non-profit organization founded in 2000 that leads genomics innovation on Canada's west coast by investing in and facilitating co-funding arrangements in genomics research while working collaboratively with government, academia and industry. Genome BC supports a variety of programs designed to invest in research that aligns with the needs of areas of strategic importance to British Columbia such as health, forestry, fisheries and aquaculture, agri-food, energy, mining and environment. Programs include:

- Programs aligned with Genome Canada
- Genome BC programs: GeneSolve Program (supports projects providing solutions to challenges from users across industry sectors); Industry Innovation Program (Provides early stage commercialization support for companies developing British Columbia-based technologies); Sector Innovation Program (supports projects that address the needs of key sectors and have the potential to generate social, environmental and economic benefits); Societal Issues Competition (for projects that identify and study the societal issues that emerge from genomics-based innovations). *https://www.genomebc.ca/*

GENOME CANADA (FEDERAL – GENOMIC RESEARCH AND TRANSLATION)

Genome Canada is a non-profit organization funded by the Government of Canada to promote and develop genomics-based technologies. Genome Canada provides large-scale investments that develop new technologies, connect the public sector with private industry, and create solutions to problems of national interest, such as health, sustainable resources, the environment, and energy. Genome Canada also funds research on the ethical, environmental, economic, legal and social aspects of genomics. Between 2000 and 2017, Genome Canada provided $1.5 billion in genomics funding across the country. Six regional genome centres – including Genome BC – develop projects for co-funding with Genome Canada. Genome Canada offers a variety of funding programs including: Large-Scale Science, Leading-Edge Technologies (Genomic technology platform); and Translation (e.g., to answer industry needs with genomics-derived solutions). Calls for proposals and priority-topics are uploaded regularly. *https://www.genomecanada.ca/*

CANADIAN INSTITUTES OF HEALTH RESEARCH (FEDERAL)

The CIHR is Canada's federal funding agency for health research, with a budget of over one billion dollars annually.

The CIHR includes a series of six funding programs including: New Frontiers in Research Fund; Training award programs (Vanier Canada Graduate Scholarships, Banting Postdoctoral Fellowships); Project Grant Program; Foundation Grant Program; Initiatives; Prizes.

CIHR support clinical trials through the Strategy for Patient Oriented Research (SPOR) and the associated networks.
https://cihr-irsc.gc.ca/e/51550.html
https://cihr-irsc.gc.ca/e/193.html

NATURAL SCIENCES AND ENGINEERING RESEARCH COUNCIL (FEDERAL)

NSERC is Canada's federal funding agency for natural sciences and engineering research. NSERC supports students in their advanced studies, promotes and supports discovery research, and fosters innovation by encouraging Canadian organizations to participate and invest in post-secondary research projects. With an annual budget of over one billion dollars, NSERC offers many different funding programs, including student scholarships, discovery research programs, innovation research programs, chairs, and some minor programs for instrumentation and equipment.
https://www.nserc-crsng.gc.ca/index_eng.asp


BRITISH
COLUMBIA