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LIFE SCIENCES VALUE PROPOSITION & COMPETITIVENESS STUDY

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OVERVIEW

Canada has the fourth largest health and biosciences sector (2018 data), behind only the United States (U.S.), the United Kingdom, and Germany¹. For the purposes of this study, the Life Sciences Sector includes the fields of biotechnology, pharmaceuticals, biomedical technologies, healthcare technologies, biomedical devices, digital health technologies, and research products and services. Additionally, for the purposes of this study, Life Sciences driven innovations that cross other industry verticals and are typically captured under these sectors (e.g., animal genetics in agribusiness) are not in the scope of this project.

Life Sciences sector clusters across Canada are made up of numerous small and medium-sized companies, which benefit from the presence of peers in the bio, pharma or MedTech fields, as well as proximity to producers, service companies and investors. Due to their dependence on a highly qualified workforce, players in the Life Sciences sector or industries within the Life Sciences sector are also increasingly seeking strong relationships with universities – and access to their students and graduates. This trend is reflected in the numerous programs, initiatives and networks designed to foster exchange of knowledge and information. The results of collaboration are often tangible, with numerous spin-offs created each year in the field of Life Sciences.

Calgary is home to a diverse range of Life Sciences companies – from start-ups and scaling-up companies, to established small and medium-sized enterprises and large organizations. Calgary has had notable success in the start-up community and with accelerating companies.



The city has robust research infrastructure through the University of Calgary and Foothills Hospital, with strengths in infectious disease, brain and mental health, clinical trials and biomedical engineering. The sector is further supported by a highly skilled, younger workforce and a well-connected transportation network, which links Calgary with other North American and international cities. In 2019, the city was ranked the world's fifth most livable city, with perfect scores in stability, health care, education and infrastructure.²

In 2018, Calgary Economic Development updated its economic strategy, *Calgary in the New Economy*, which identified Life Sciences as an emerging sector. Since the update, Calgary Economic Development has undertaken additional studies and analysis to further define the Life Sciences sector to support broad efforts to showcase Calgary's value proposition to attract and retain further investment and identify potential support to build on the sector's momentum and growth trajectory. The Life Sciences sector, and particularly Calgary's sub-sectors or areas of strength and competitive advantages within Life Sciences, provides emerging opportunities to attract more investment, jobs and growth to Calgary.



¹ [https://www.ic.gc.ca/eic/site/098.nsf/vwapj/ISED_C_HealthBioscience.pdf/\\$FILE/ISED_C_HealthBioscience.pdf](https://www.ic.gc.ca/eic/site/098.nsf/vwapj/ISED_C_HealthBioscience.pdf/$FILE/ISED_C_HealthBioscience.pdf)

² The Economist Intelligence Unit. The Global Liveability Index 2019

SCOPE & CONDUCT OF WORK

KPMG was engaged by Calgary Economic Development to better understand the current Life Sciences ecosystem's players, assets, and attributes. The intent is to clearly describe Calgary's Life Sciences value proposition to enable Calgary Economic Development to further support and promote the sector's development.

The study is divided into two parts:



To provide a deeper understanding of the current state of Calgary's Life Sciences ecosystem, showcasing its competitiveness and strengths; and



To conduct comparative analysis of the sector with select North American cities and provide recommendations to help mature the sector. This part of the study highlights Calgary's value proposition and competitive advantages.

For Part A, KPMG gathered insights through strategic stakeholder engagement and conducted desktop research to describe the current ecosystem. KPMG also assessed global trends in applicable sub-sectors to identify areas of growth, which could be leveraged to mature Calgary's Life Sciences sector. KPMG then conducted research on four comparable jurisdictions in North America to identify relevant lessons learned, comparative advantages, and challenges, which could help set Calgary apart among other regions for investment attraction in the Life Sciences sector.

For Part B, informed by discussions with Calgary Economic Development and insights from Part A, a value proposition highlighting the city's key strengths and differentiators was developed. The KPMG City Competitiveness Index was utilized to assess Calgary's competitiveness within Life Sciences related to eight comparable jurisdictions in North America. Following a gap analysis informed by findings from Part A, key investment attraction criterion and a supporting implementation roadmap at a high level to growing the sector were also developed.

This Report presents findings from both Part A and B of the Life Sciences Value Proposition and Competitiveness Study. The Report is structured as follows:

- **Section 1:** Provides an overview of Calgary's Life Sciences sector, including key stakeholder groups, areas of strength and opportunities for improvement.
- **Section 2:** Summarizes Calgary's strengths and areas of opportunity to grow the sector.
- **Section 3:** Outlines findings from the jurisdictional research, highlighting global trends and leading practice.
- **Section 4:** Provides an overview of Calgary's competitiveness in the Life Sciences sector, relative to comparable select jurisdictions in North America.
- **Section 5:** Outlines the value proposition for Calgary's Life Sciences sector for potential investors.



EXECUTIVE SUMMARY

Calgary has demonstrated strengths in several sub-sectors, which present the greatest opportunities for growing and maturing its Life Sciences industry: diagnostics, oncology, digital health and microbiome. Specifically, these sub-sectors were identified as having robust market activity (both locally and internationally), as well as investment from industry, research organizations, and government.

However, discussions with stakeholders also identified potential challenges and roadblocks to growth. If addressed, these challenges present opportunities to strengthen the local ecosystem and position Calgary for increased investment.

The study identified key global trends changing Life Sciences, which Calgary must consider as it grows and matures in this sector. Trends such as application of new technologies like Blockchain, artificial intelligence (AI), and 5G are changing sector fundamentals, while demographic shifts are putting more pressure on the sector as populations age. Personalization of healthcare solutions alongside the prominence of self-health applications and technology means creating new ways to provide healthcare.

When compared to other Life Sciences 'hubs or jurisdictions across North America in a comparative analysis using KPMG's City Competitiveness Index (CCI), Calgary ranked highly across all qualitative and quantitative factors with respect to the Research & Development (R&D) Tangible Products, Assembly and Manufacturing, and Technology Intensive Manufacturing business personas. In addition, within the Distribution Centre business persona (the process of delivering goods from one location to another, including storage, unloading, and unpacking), an important component of the Life Sciences ecosystem, Calgary ranks well in overall competitiveness among North American cities. Compared to North American cities assessed, the city ranks first for tax costs and second for labour costs in terms of distribution centres.

Calgary's Life Sciences sector value proposition was developed based on the comprehensive, multi-dimensional analysis of its ecosystem alongside comparisons to other cities across North America. The value proposition is the culmination of primary research through stakeholder interviews and focus groups, including Life Sciences sector experts across North America, and extensive secondary research through KPMG's CCI and desktop research.



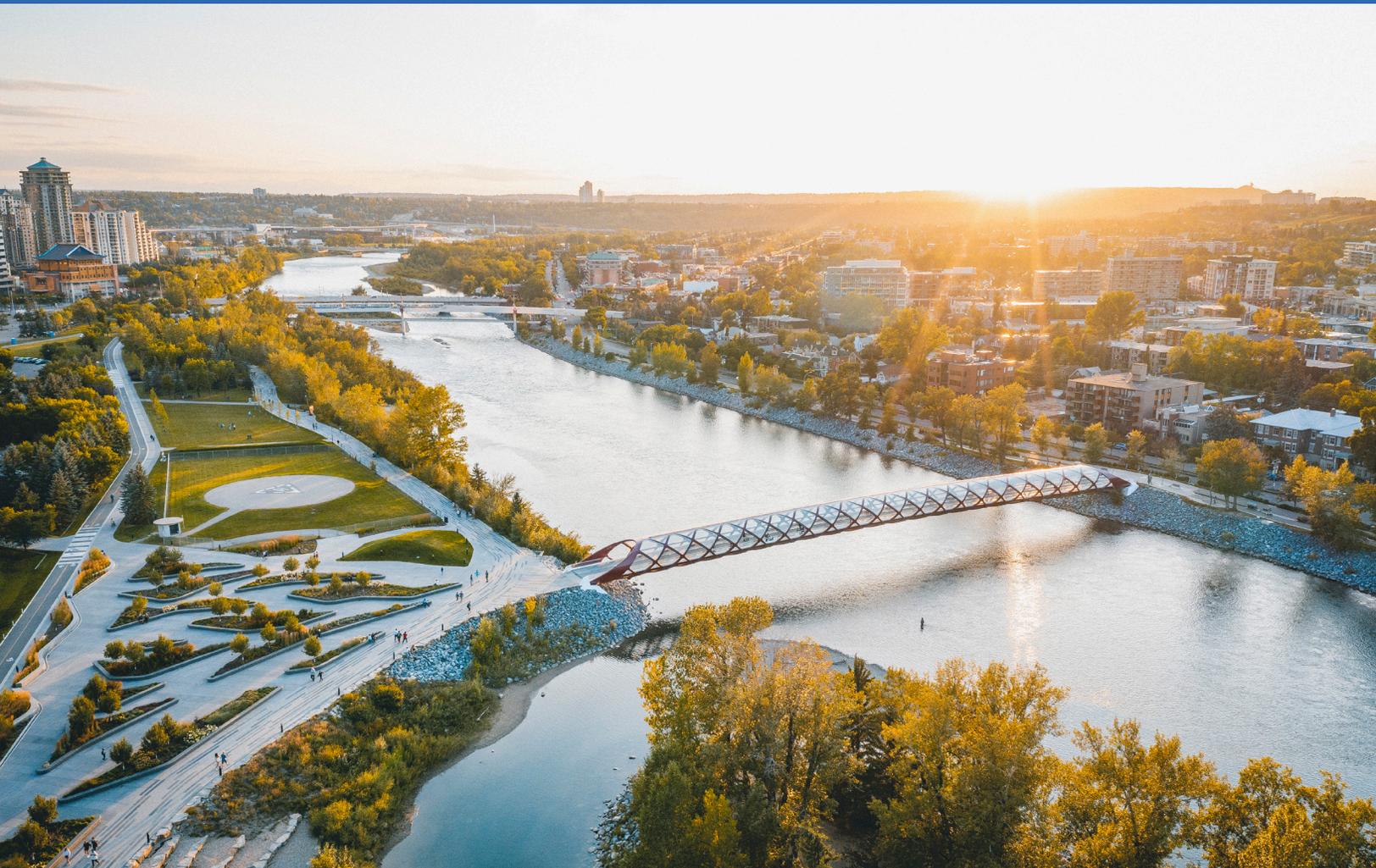
CALGARY'S LIFE SCIENCES VALUE PROPOSITION

Calgary's Life Sciences ecosystem is expanding and innovative. Precipitated by emerging local companies and highly skilled talent, investors have an opportunity to be part of this dynamic and growing sector developing products and services for world markets.

Calgary's assets are distinct. Top-tier institutions, such as the International Microbiome Centre – the world's largest germ-free facility – and the Calgary Cancer Centre – the second largest in North America once completed – are leading the way in internationally recognized research and development. Homegrown start-ups are at the forefront of turning these insights into tangible diagnostics, digital health, oncology and microbiome solutions within Canada's largest and only province-wide integrated health system. University programs, such as the University of Calgary's Biomedical Engineering Program, help provide the sector with the necessary Life Sciences-related skillsets across the Calgary-Edmonton corridor. Calgary is ranked as the fifth most liveable city in the world due to affordability, access to recreational opportunities and diversity – ensuring the City continues to attract and retain top-tier talent.

Growth in the sector is enabled by Calgary's ability to access national and global markets. Calgary has competitive logistics and distribution advantages – including linkages to the rest of Canada, the United States and Mexico – which support cold chain distribution. Furthermore, Canada has 14 active free trade agreements covering 51 countries, connecting businesses to 1.5 billion consumers and nearly two-thirds of the world's GDP.

Calgary's economic landscape is changing, and Life Sciences is at the forefront. The time is now for investors to benefit from what the City has to offer.



OVERVIEW OF CALGARY'S LIFE SCIENCES SECTOR

With a strong academic base and growing number of start-up companies, Calgary's Life Sciences sector is well positioned for potential future growth. The Life Sciences sector in Alberta, and Calgary more specifically, includes several growing sub-sectors. Overall, the sector contributes to the province's highly skilled, and knowledge-based economy through a growing number of start-ups and small businesses along with a set of established companies.³

Industry Presence

Calgary's Life Sciences ecosystem includes more than 110 verified industry organizations, with a notable portion of companies currently in the start-up or scale-up phase. According to North American Industry Classification System (NAICS) codes, 5,699 organizations related to Life Sciences are located in Calgary. Of these organizations, only 118 employ over 100 employees. While challenges and limitations exist with utilizing NAICS codes, they provide a general overview of the scale of Calgary's Life Sciences sector.

Alberta, and Calgary more specifically, is seeing an increase in the establishment of start-ups. 45 per cent of companies within Alberta were founded within the past five (5) years, with another 37 per cent within the past 15 years. As indicated by the chart below, the largest two categories, Digital Health and Medical Devices, represent over 60 per cent of the number of organizations in the Calgary Life Sciences ecosystem.

Established companies continued to be important contributors to the local economy, which includes several publicly traded companies. According to BioAlberta's 2019 industry report, 11 per cent of companies surveyed reported having revenue equal to or above \$10 million in 2018. These companies also remain a significant employer, with 7 per cent of companies being accountable for providing jobs to 82 per cent of all employees in the sector.⁴ Additionally, in light of the current COVID-19 pandemic, some of these companies are continuing to see growth through new opportunities. For example, Orpyx Medical Technologies was recently awarded a \$60 million two-year contract by⁵ Alberta Health Services to provide locally made medical masks.⁶



RESVERLOGIX CORP/ ZENITH EPIGENETICS

Zenith Capital Corporation is a biotechnology investment company focused on R&D for cancer and other disorder therapeutic treatment. The company continues to focus on clinical trials for prostate, breast and ovarian cancers. Zenith was developed out of Resverlogix Corp (TSX: RVX) in 2013. According to the company's 2020 corporate outlook, the organization has an estimated enterprise value of \$250M USD. The organization has large-scale partnerships with multi-national pharmaceutical companies (such as Pfizer).

ONCOLYTICS BIOTECH INC.

Oncolytics Biotech's (TSX: ONC) focus is on obtaining regulatory approval for pelareorep for metastatic breast cancer. Pelareorep is currently manufactured at commercial scale through a supply agreement with MilliporeSigma. The organization has several partnerships with industry, including Pfizer and Merck KGaA. As of 2020, the company had over 393 global patents and spent over \$2.5M on R&D.

³ BioAlberta. Life Sciences in Alberta – State of the Industry 2019

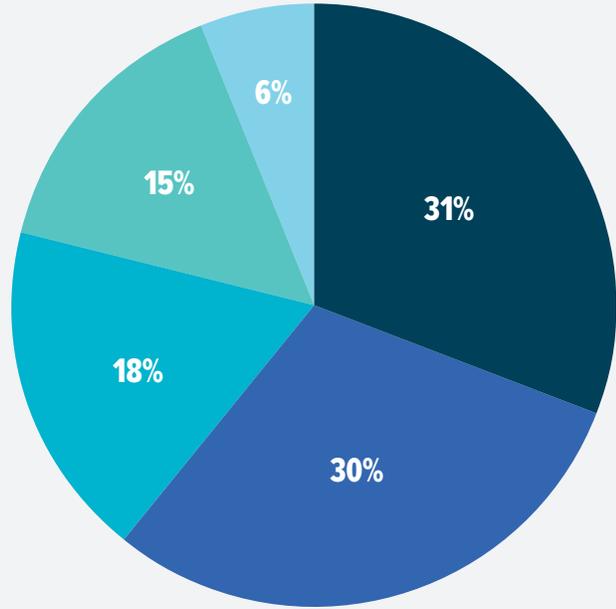
⁴ BioAlberta. Life Sciences in Alberta – State of the Industry 2019

⁵ Calgary Economic Development, 2021

⁶ Orpyx Medical Technologies. <https://www.orpyx.com/orpyx-news/made-in-calgary-masks-to-help-protect-albertans>

MAKEUP OF CALGARY'S LIFE SCIENCES COMPANIES BY SUB-SECTOR

- Digital Health
- Medical Devices
- Therapeutics & Pharmaceuticals
- Diagnostics
- Other



A strong entrepreneurial spirit within Calgary was noted in stakeholder discussions as the reason for the growing presence of start-ups in the city. This spirit was often attributed to the legacy of the oil and gas sector.

While Calgary is seeing growth in the number of start-ups, industry stakeholders noted challenges in growing their companies due to a lack of a local 'anchor tenant'. An 'anchor tenant' is a large organization with broad appeal that helps attract interest to a specific region or location. The 'anchor tenant' was identified as a key partnership and growth opportunity for companies looking to obtain their first buyer, or to scale-up by leveraging partnerships (and therefore existing supply chains) of these organizations.



Research & Development (R&D)

The University of Calgary, a member of the U15 Group of Canada's top research-intensive universities, is a strong contributor of R&D, supported by investments made by the university within the key sub-sectors. The university is the primary source of skilled talent for the region and is increasingly focused on supporting entrepreneurialism and commercialization. Indeed, the University of Calgary attracts more funding per graduate student than any of the top 10 universities in Canada. The University of Calgary also hosts unique and complex scientific research and testing equipment, which contribute to broad research and development programs at the university. It also provides local companies with access to equipment, which they may otherwise be unable to afford independently.

The University of Calgary has 34 hectares of incubation space through the University Innovation Quarter and has contributed to a 75 per cent increase in start-ups in the city. As identified through a recent economic impact assessment, the University's R&D efforts supported 360 new inventions and innovations, which resulted in \$8.2 billion in economic impact from research⁷.

In addition to BSc, MSc and PhD programs within key Life Sciences related fields (such as biochemistry, biomedical, exercise and health physiology, etc.), the University has several programs aimed at supporting R&D and product commercialization, including⁸:

Cumming School of Medicine

University of Calgary's medical school, focused on research and innovation in medical sciences. The school conducts life and medical sciences research across 7 research institutes.

Biomedical Engineering (BME) Program

Housed within the Schulich School of Engineering, the BME program integrates over 340 scholars and six faculties, working in multidisciplinary teams at more than 40 unique, state-of-the-art facilities across campus.

International Microbiome Centre

Translational research centre aimed at investigating human, plant and animal microbiomes and the physical environment. The Centre includes the world's largest germ-free facility, real-time imaging, mass cytometry and genomics⁹.



Innovate Calgary

Innovation and transfer business incubator where research is translated to industry solutions. The incubator offers support related to intellectual property (IP) management, licensing, marketing, research partnerships, and start-up programs.

Life Sciences Innovation (LSI) Hub

Facility designed to build and grow Life Sciences-based companies. Established by Innovate Calgary, the hub is open to students, researchers, and start-up companies. The LSI Hub is a 127,000 square foot facility with 35,000 square feet of wet and dry lab space.

Ward of the 21st Century (W21C)

Facility serves as a research and beta test-site for exemplary hospital design, novel approaches to health care delivery, human factors research, and innovative medical technologies.

UCEED

Western Canada's first university-based private equity fund managed by students. The program helps pre-seed and seed funding start-ups commercialize new health-based technologies.

IMPACT

Facilitates the process of navigating the local research environment, providing end-to-end support of clinical trials required to license and sell new medical devices, software, or pharmaceuticals in various domestic and international markets.

The Hunter Hub for Entrepreneurial Thinking

he hub helps support entrepreneurialism and innovation among students and faculty. The hub focuses on four core activities: programming and events; access to funds; network cultivation; and creative collaboration.

In addition to the University of Calgary, investments by Government (AHS) have been made to support R&D in the province. Examples include the Tom Baker Cancer Centre and the Calgary Cancer Centre (with an anticipated completion date of 2023). Once built, the Calgary Cancer Centre will be the largest cancer treatment and research facility in Canada, and the second largest in North America¹⁰.



⁷ University of Calgary, 2021. https://ucalgary.ca/about/our-organization/economic-impact?utm_source=economic-impact&utm_medium=redirect&utm_campaign=redirect

⁸ University of Calgary, 2021

⁹ Calgary Herald. <https://calgaryherald.com/health/world-largest-germ-free-lab-opens-at-university-of-calgary>

¹⁰ <https://building.ca/new-calgary-cancer-centre-aims-for-transformed-clinical-experience/#:~:text=Under%20construction%20since%20late%202017,second%20largest%20in%20North%20America.>

Talent

The University of Calgary supports and trains a strong talent pool and new graduates. Calgary has the highest proportion of STEM degree graduates with bachelor's degrees or above of any major Canadian city. For example, a total of 3,532 students were enrolled in Life Sciences-related fields in 2020¹¹. Additionally, in 2019 the Cumming School of Medicine awarded 331 undergraduate and 145 graduate degrees. The proximity of the University of Alberta, another U15 member, provides a further talent pool available in the Calgary-Edmonton innovation corridor. The labour force within the city is young, with a median age of 37.2 years¹².

Discussions with KPMG subject matter experts revealed that Life Sciences investors consider the talent pool as one of their top investment decision factors. The University of Calgary helps to supply the required talent for the sector. However, increasing talent retention rates to the region is critical for future, sustained growth.

In addition to available talent, investors also take labour costs under consideration. Lower Canadian labour costs, compared to some U.S. counterparts, present an opportunity for Calgary to showcase its cost competitiveness.



Alberta Health Services

AHS is the largest fully integrated provincial healthcare system in Canada. The AHS Calgary Zone includes 14 hospitals, 3,076 physicians, 37,000 employees and 4,623 volunteers¹³. One of AHS' greatest assets is access to a single healthcare data source. The organization has one of the largest, most mature, and comprehensive health system data repositories in Canada. The new \$459 million ehealth system, Connect Care, integrates more than 1,300 information systems from 400 facilities¹⁴.

As the largest provider of healthcare services, AHS is a significant procurer of Life Science products and services. The organization appears to be a natural first buyer, a critical component of success for Calgary's start-up companies. As revealed through discussions with stakeholders, however, AHS has not filled that role for most start-up companies.

On the other hand, concerns were raised by stakeholders about the suitability of AHS serving as the first-time buyer for innovative products. First-time buyers can be critical for the success of start-up companies to demonstrate proof-of-concept for their products. The ability to demonstrate proof-of-concept is of particular importance for Life Sciences companies, which often focus on the development of innovative products. Given the scale of the integrated system, companies are often required to supply large quantities of product. Supply chain disruptions could have detrimental effects on the provision of healthcare services across the province. As such, start-ups have looked to less integrated markets (such as Ontario), whereby single hospitals can serve as first buyers and help provide proof-of-concept.

AHS could however still present an opportunity for increased partnership with industry to incorporate innovative products in the province's healthcare system. While AHS may not be suitable for all new and innovative Life Sciences products, an opportunity for increased usage of healthcare data exists – provided all required and appropriate ethical and confidentiality guidelines are adhered to. For example, advancements are being made in the areas of health analytics and diagnostics, particularly the opportunity to leverage the rich health data resources in Alberta for synthetic data applications using AI and machine learning tools.

Additionally, improved access to the University of Calgary's laboratories presents an opportunity to provide vital infrastructure for start-up companies. Laboratory access can be a large capital investment for start-up companies that may only require occasional ad hoc usage. Stakeholders noted that while access to the University's laboratories is improving, there are still barriers and perceived large usage fees.

¹¹ University of Calgary, 2021

¹² Calgary Economic Development

¹³ Alberta Health Services, <https://www.albertahealthservices.ca/assets/zone/ahs-zn-calgary-map-brochure.pdf>

¹⁴ Calgary Economic Development.

Enabling Environment

Support services provided through incubators and accelerators can be an important element in helping to grow start-up and scale-up companies. In addition to the university initiatives mentioned above, there are several programs available to entrepreneurs in Calgary, and industry more broadly, including:

HATCH-YYC

Calgary's first health technology accelerator and incubator. Powered by local secure communications company Brightsquid, the program enables platform integration with leading Canadian electronic medical record systems.

BioHubX

A not-for-profit organization which provides lab and office facilities, equipment, scaleup support, expertise and community for companies and groups advancing technologies in health, human performance and life science.

Alberta Innovates

The province's primary research and innovation agency, focused on funding and support for commercialization.

Calgary Economic Development

Calgary's economic development agency, focused on growing the city's economy and attracting investment (with a focus on key sectors, including Life Sciences as a key emerging sector).

Creative Destruction Lab-Rockies

An accelerator program for scalable, seed-stage, science and technology companies. The program is part of the University of Calgary's Haskayne School of Business.

Professional business services

This includes large professional service firms (such as the "big four" accounting, tax and advisory firms); law firms specializing in regulatory, IP and other services; and small boutique firms focused on providing specialized expert services.

Support organizations, such as incubators, accelerators and economic development organizations can serve as the "glue" for the Life Sciences ecosystem. They can help provide and/or promote a unified vision and mission for the sector, while helping to increase awareness about recent activities and resources available. While stakeholders noted the value add of some of these organizations, concerns were also raised about collaboration, awareness and working towards a 'common goal'. An opportunity exists for these organizations to increasingly serve as this glue, linking various actors across the ecosystem and helping to promote a unified message to the market.

Additionally, while the City provides various supports to start-up companies, a gap exists in aiding scale-up companies to grow. Addressing this gap can help ensure sector growth and the retention of these organizations through to commercialization and beyond.

Support organizations can also be critical in promoting industry interests and helping to foster an environment conducive to investment attraction. This includes advocating business needs to government, including increased and/or expanded eligibility for funding supports, additional incentives (including lowering tax burdens), and other initiatives. Currently, Alberta has a competitive general corporate tax rate of 8 per cent, compared to provinces such as British Columbia (BC), with a current tax rate of 12 per cent, and Ontario and Quebec at 11.5 per cent.

While talent and access to capital are pivotal for international Life Sciences investment attraction, cost factors (such as tax, facilities, labour, transportation, utilities) remain a key consideration for investors. The international investment space can be fiercely competitive, which is why having competitive cost factors remains essential. Governments have a role to play in fostering this environment, which increases investment attraction opportunities.

Given the importance of skilled labour for the sector, Life Sciences investors often weigh non-cost factors (such as quality of life, ease of doing business, innovation and IP protection, size of experienced workforce, etc.) highly in their investment decisions as these factors align closely with their target talent pool. The higher importance of non-cost factors for investment attraction compared to some sectors (e.g. manufacturing) is due to the demand for skilled Life Sciences professionals. Oftentimes, these individuals have employment opportunities and will prioritize areas with a higher quality of life.

Calgary's quality of life metrics, including its proximity to the Rocky Mountains, outdoor activities (such as skiing and biking), present an opportunity to attract these sought-after individuals. Attracting these individuals however will require increased awareness of the benefits of living in the city, in addition to sector-specific employment and investment opportunities.

Access to Funding and Financing

As mentioned previously, access to capital was noted by stakeholders as one of the biggest challenges to growing the sector. While there is a growing number of start-ups, significant barriers to scaling-up were highlighted.

A lack of local Life Sciences investors (including venture capital), and a lack of awareness of opportunities within Calgary by international investors were noted amongst the primary reasons for capital inflow challenges. The lack of awareness for international investors was not linked specific to the Life Sciences sector, but the city more broadly – with the oil and gas industry being an exception.

Through interviews, stakeholders noted several opportunities to address this gap. For international investors, this includes increased marketing and education campaigns, and partnerships with Life Sciences clusters across Canada to help improve overall awareness. For local investors, potential educational campaigns for investors outside of Life Sciences were discussed. Conversations with KPMG Life Sciences subject-matter experts however highlighted the challenges in attracting investors from other sectors (such as technology) due to differing timelines and returns on investment.

The Alberta Enterprise Corporation aims to help address the venture capital gap in the province, by working to create a growing venture capital industry. An opportunity exists for the corporation to increase the focus on the Life Sciences sector and help address the capital inflow gap.

Progress is being made, however. In fact, a 2021 PwC-commissioned Health and Life Science Report found 49 per cent of survey respondents (Life Sciences sector companies in Alberta) sourced funding from Calgary, and 57 per cent of respondents had undergone one or more rounds of funding. This showcases the increasing maturity of Alberta, and Calgary's, Life Sciences sector ecosystem.

Additionally, the Government of Alberta has recently launched the Innovation Employment Grant, a new program for small and medium-sized enterprises at the beginning of 2021. The program includes a grant of up to 20 per cent towards qualifying research and development expenditures¹⁵.

At the municipal level, the City of Calgary has established the Opportunity Calgary Investment Fund (OCIF) in an effort to attract investment and anchor companies. Specifically, OCIF is a \$100 million municipal, milestone-based fund aimed to support proliferation of technology and innovation in the city. Funding is awarded following a competitive process, with evaluations made by an independent OCIF Board of Directors¹⁶.

Federally, the Government of Canada supports innovative projects of over \$10 million through the Strategic Innovation Fund. The funding is intended to support R&D and commercialization, including the growth and expansion of firms and attraction and retention of large-scale investments in Canada. Additional funding initiatives through Innovation Science and Economic Development Canada (ISED) aimed at supporting Life Sciences growth include: Strategic Innovation Fund, Canada Foundation for Innovation; Genome Canada; Innovation Support Clusters Initiative, among others.

While there are several federal programs, stakeholders noted challenges in accessing funding due to the primary focus placed towards Eastern Canada. Specifically, one stakeholder noted receiving a rejection letter for funding through a federal program as the company wasn't located within eastern Life Sciences corridors (e.g. Toronto, Montreal, etc.).



¹⁵ <https://www.alberta.ca/innovation-employment-grant.aspx>

¹⁶ <https://calgaryeconomicdevelopment.com/about-us/initiatives/opportunity-calgary-investment-fund/>

Logistical Support

Calgary is a well-connected distribution hub in Western Canada, with strong linkages to the U.S. (one of the world's largest consumer markets). Prior to the COVID-19 pandemic, the city connected 140 flight destinations with over 85 direct routes to Asia, Europe and the Americas. Additionally, 11 million customers are reachable via truck delivery in a scheduled day. The city is also connected to the east and west via the TransCanada Highway, and the United States and Mexico through the CANAMEX corridor¹⁷.

Transportation costs and ease of transporting goods to key markets is an important consideration for investors when making investment decisions. Not only is Calgary connected via a well-established transportation network, but Canada's free-trade agreements (such as the Canada-United States-Mexico Agreement, the Canada-European Union Comprehensive Economic and Trade, etc.) provide investors with vital connections to global markets through their Canadian operations.

As the COVID-19 pandemic has highlighted, having reliable access to healthcare supplies, such as personal protective equipment (PPE), and vaccines can be critical. This access comes both in the form of distribution networks and supply

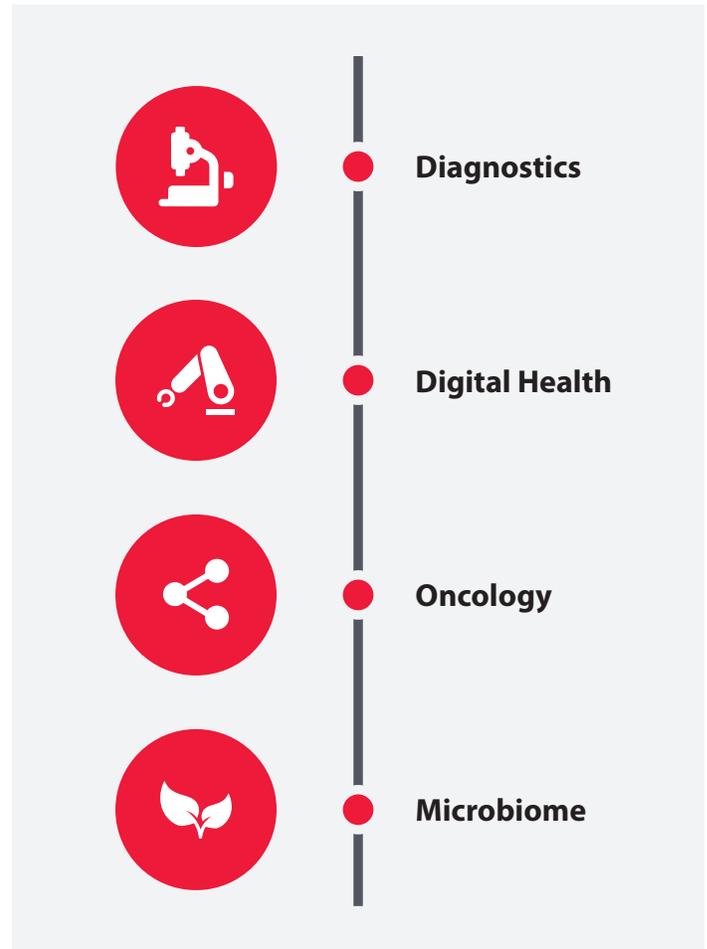
chains. Businesses take an end-to-end view of their supply chain management. This includes assessment and mapping of their supply chain flows, with particular attention to critical sources and materials, review of contracts with suppliers, risk management and modelling for disruption, and costing the impact of changes. Given the instability and protectionism exhibited by some jurisdictions, international investors are increasingly looking to Canada to serve as the critical link to accessing the North American market. This includes both the provision and development of medical supplies and equipment. An opportunity exists for Calgary to play this role by leveraging the region's transportation network, and the country's free trade agreements and international reputation for stability.

Calgary's position within Western Canada provides easy access to Silicon Valley, with investors able to travel to and from San Francisco and back within a single day. The city is also more accessible to the Western U.S. than is the Eastern U.S. – between flight times and numerous time zone changes. Further promoting this accessibility and ease presents a potential opportunity to further increase Calgary's attraction for investors located in the Western Canada and Western U.S.

STRENGTHS AND OPPORTUNITIES IN CALGARY'S LIFE SCIENCES SECTOR

Calgary is well positioned to grow the Life Sciences sector. To do so, the city will need to play on existing strengths while embracing emerging opportunities. Specifically, through research and stakeholder discussions, opportunities for sector growth were identified in four key sub-sectors.

While opportunities exist within the sector more broadly – including areas related to brain and mental health, and sports medicine, etc. – the above sub-sectors were identified as having robust market activity (both locally and internationally), as well as investment from industry, research organizations, and government.



Diagnostics

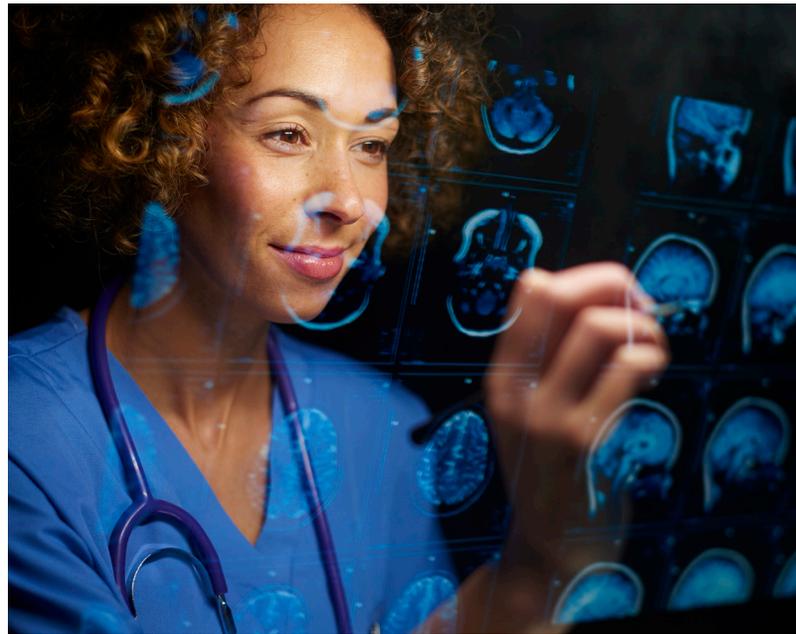
With an ageing population and changing lifestyles causing an increase in conditions like cancer, diabetes and heart disease, demand for diagnostic services is growing¹⁸. Given Calgary's strong R&D assets, including the Cumming School of Medicine, as well as emerging diagnostic companies, Calgary is well positioned to harness growth in the sub-sector.

One of the goals of the global diagnostic sector is to build further integration of information and systems to enhance the ability for personalized patient care. Given that AHS is already a well-integrated web throughout the province, in some respects they are leading the advancements for better integration of information systems to provide a holistic picture of a patient's health. Therefore, building upon this integrated network with new technologies that are looking for real-world testing opportunities to enhance diagnostic performance, quality of diagnosis, and improved service and safety standards could be an opportunity.

Digital Health

Healthcare is increasingly moving towards personalization. Due to the rise of connected health (e.g. Telehealth), providers are becoming better equipped to deliver personalized services to patients and customers. Given these changes, there is growth in the sub-sector due to strong investor confidence and investment opportunities. The sub-sector globally has seen a record breaking 56 mergers and acquisitions in the digital health market. Over 13 of these had a disclosed value of over \$7.6 billion USD, showing investors' tangible commitment to the opportunities in the sector and thus presenting an opportunity to grow the sub-sector locally.

As identified through conversations with stakeholders, Calgary is increasingly seeing an emergence of start-ups focused on providing digital health products and services. Additionally, medical device providers make up a significant portion of companies in the sector. Coupled with industry supports within the ecosystem, through local accelerators and incubators, this sub-sector is well positioned for future growth.



Oncology

Oncology is one of the world's fastest growing therapeutic areas. The sub-sector is expected to represent 26 per cent of pharmaceutical sales by 2022. This rate of growth poses an opportunity to leverage current assets (e.g., Tom Baker Cancer Centre and the Cummings School of Medicine) in the local sub-sector.

Furthermore, the sub-sector is seeing an increase in cancer incidences, healthcare budget pressures, increasing pharmaceutical R&D costs, and reduced revenue potential. To address these challenges, the sub-sector is increasingly looking for growth opportunities in emerging markets and Calgary's oncology sub-sector is an emerging market ripe for opportunity with some significant assets in place that build a strong foundation. Once completed, the Calgary Cancer Centre will further strengthen the city's standing in the sub-sector.

Microbiome

While there is a high cost associated with clinical trials, there is an opportunity for growth for start-up companies that are offering tools to increase the quality of data and insights generated. The match between start-ups finding better tools and large companies providing funding for clinical trials is leading to an increase in the number of partnerships and acquisitions by large pharmaceutical companies of microbiome-based therapeutics companies. The sub-sector is generating a lot of interest and investment. With the North America market in 2017 expected to increase nearly four times its size by 2025. Growth in the sector presents an opportunity for Calgary to develop early-stage companies through the support of the International Microbiome Centre.



LEVERAGING EXISTING STRENGTHS AND EMERGING OPPORTUNITIES

An effective Life Sciences ecosystem is one which helps drive the successful development and commercialization of health and well-being products and services. Through conversations with stakeholders, research and KPMG industry insights, the following components were identified as key contributing factors to Calgary’s Life Science sector’s growth thus far. Further growing and evolving these elements is required for Calgary to keep pace with supporting the sector’s development and maturation.



The below table summarizes these components through the lens of the elements identified as critical for growth. Calgary’s competitiveness as it relates to the below areas will be further assessed through Part B.

STRENGTHS	OPPORTUNITIES
 <p>Strong R&D Institutions</p> <ul style="list-style-type: none"> • Calgary is home to leading-edge Life Sciences R&D institutions. • The University of Calgary’s numerous programs are leading the way in research and innovation in the above sub-sectors. • The university is increasingly supporting faculty and staff in their entrepreneurship endeavors (through initiatives such as the Life Sciences Innovation Hub). • Additional investments have been made in R&D by the Government of Alberta. Examples include the Tom Baker Cancer Centre and the Calgary Cancer Centre. 	<ul style="list-style-type: none"> • While improvements have been made, further opportunities for increased collaboration between academia and industry exist. • Further opportunities also exist to continue to improve commercialization and IP ownership terms between the university and users of the university’s incubator and accelerator services. • Increased collaboration would further enable the commercialization of concepts from academia and provide access to critical infrastructure (such as laboratory space) for start-up companies.
 <p>Robust Industrial Presence</p> <ul style="list-style-type: none"> • If leveraged effectively, future growth is likely to be driven by the growth and maturation of start-up companies. • A strong entrepreneurial spirit within Calgary was noted through stakeholder discussions as the reason for the growing presence of start-ups. • Entrepreneurialism is increasingly supported by organizations – such as local incubators and accelerators – aimed at helping start-up companies succeed and find commercial success. 	<ul style="list-style-type: none"> • While Calgary is seeing growth in the number of start-ups, industry stakeholders noted roadblocks in obtaining local first-time buyers. • Addressing this challenge – through increased opportunities to partner with AHS and attracting an ‘anchor tenant’ to the city – would help companies scale-up, demonstrate proof of concept and attract international investor attention.

STRENGTHS

OPPORTUNITIES



Available Talent Pool

- 75 per cent of Life Science founders have previous experience in establishing a start-up¹⁹.
- The University of Calgary supports a strong talent pool and addition of new graduates.
- Calgary has the highest proportion of STEM degree graduates with bachelor's degrees or above of any major Canadian city.
- Leading R&D programs, such as the International Microbiome Centre and the Calgary Cancer Centre (once completed), are helping to further build the pool of available specialized talent in the region.

- Showcasing opportunities for graduates to find meaningful employment, which allows for continued career growth will help ensure new talent stays in the city.
- Opportunities exist for industry to increasingly partner with academia (e.g. through internships) to help facilitate the transition between school and employment for students.
- Addressing talent gaps (such as available regulatory expertise, marketing supports, etc.) will help ensure a robust talent supply chain is available locally for growing and new companies.



Accessible Infrastructure and Resources

- Calgary has robust research infrastructure through the University of Calgary and Foothills Hospital, among others.
- A growing number of resources for start-up companies are available through local incubators, and accelerators (such as HATCH-YYC).

- Opportunities for further collaboration, including leveraging the university's infrastructure and resources for R&D purposes by industry exist. This includes improving access for potential partnership opportunities with AHS for local companies.
- While the city provides various supports to start-up companies, a gap exists in aiding scale-up companies grow. Addressing this gap can help ensure growth and the retention of these organizations.
- An opportunity exists for an organization (such as Calgary Economic Development) to provide alignment on a common goal for the sector and increased awareness of activities within the ecosystem.



Access to Funding & Financing

- All three levels of government – from the City of Calgary to the Governments of Alberta and Canada – provide funding programs aimed at growing and supporting local Life Sciences organizations.
- Examples of government programs include the Province's recently launched Innovation Employment Grant; Calgary's OCIF fund, and the federal government's Strategic Innovation Fund.

- Access to capital was noted by stakeholders as one of the biggest challenges to growing the sector.
- A lack of local Life Sciences investors (including venture capital), and a lack of awareness of opportunities within Calgary by international investors were noted amongst the primary reasons for capital inflow challenges.
- Through interviews, stakeholders noted several opportunities to address this gap. This includes increased marketing and education campaigns about opportunities in the sector and partnerships with Life Sciences clusters across Canada to help improve overall awareness.

STRENGTHS

OPPORTUNITIES



Enabling Environment

- Currently, Alberta has a competitive general corporate tax rate of 8%, compared to provinces such as BC, with a current tax rate of 12%, and Ontario and Quebec at 11.5%. This is an important cost factor to be highlighted to potential investors.
 - Calgary ranks highly in terms of quality of life metrics. This strength should be a strong focal point in promoting the region to potential investors and talent looking to relocate to the region.
 - Facilities costs are an important component assessed by investors. The COVID-19 pandemic has improved access to more affordable and sought-after (pre-pandemic) facilities in the city.
- While Calgary has strengths in terms of costs (e.g. tax and facilities), and non-cost factors (e.g. quality of life), awareness of the city's benefits are oftentimes lacking.
 - Through increased education and marketing efforts, investors can be exposed to the non-cost related benefits of the city (an important element of determining Life Sciences-based investment decisions).
 - Calgary's competitiveness and areas for further improvement as it relates to cost factors will be assessed at a high-level through Part B.



Logistical Support

- Calgary is a well-connected distribution hub in Western Canada, with strong linkages to the U.S. (one of the world's largest consumer markets).
 - The city is also connected to the east and west via the TransCanada Highway, and the United States and Mexico through the CANAMEX corridor.
 - Canada's free-trade agreements (such as the Canada-United States-Mexico Agreement, the Canada-European Union Comprehensive Economic and Trade, etc.) provide investors with vital connections to global markets through their Canadian operations.
 - Calgary's position within Western Canada provides easy access to Silicon Valley, with investors able to travel to and from San Francisco and back within a single day.
- While Calgary is a well-connected city, stakeholders noted a lack of awareness on this point by investors.
 - Further promoting this accessibility and ease presents a potential opportunity to further increase Calgary's attraction for investors located in Western Canada and Western U.S.

GLOBAL TRENDS

As part of this study's analysis, KPMG undertook a scan of global trends within each of Calgary's leading sub-sectors. Below is an overview of trends within each sub-sector.

Digital Health

The primary goal of digital health products and services is to improve patient experience and patient engagement. Globally, the sector is seeing growth due to strong investor confidence and perceived investment opportunities²⁰.

Healthcare across the globe is moving towards increased personalization. Due to the rise of connected health (e.g. Telehealth), providers are able to deliver personalized services to patients and customers. This is enabled through greater collection and sharing of patient health data. Electronic health records, and the Internet of Things (IoT) have allowed providers to adjust interventions to more closely align with the needs of patients. The large volume of data that is directly collected from consumers and patients via the use of digital health technologies can also be leveraged to track trends and patterns regarding health, which can explain, influence or predict health related outcomes.

Consumers and patients are also becoming increasingly involved in the provision and management of the healthcare they receive. Through self-health monitoring and mHealth (mobile-based healthcare), patients are able to track activities related to their healthcare management – from the amount of their daily exercise to eating habits. This has been furthered by the rise of wearable technologies (“wearables”), hearables and sensors. This has led to consumers and patients increasingly looking for better value-added services, improved communication and better channels of engagement with healthcare providers²¹.

Emerging technologies, such as Distributed Ledger Technology (DLT), AI, extended reality (XR) and quantum computing are all helping to propel the advancement of digital health solutions. Increasingly, the sub-sector is seeing the rise of human and machine collaboration, which can improve health outcomes²². Given the intersection between healthcare and technology, strong collaboration between healthcare providers, governments (for regulatory purposes), and technology companies is required.

The sub-sector has seen a record breaking 56 mergers and acquisitions in the digital health market. Over 13 of these, had a disclosed value of over \$7.6 billion USD. Examples include Roche and Flatiron health; Amazon and PillPack; LogisticCare & Circulation, etc.²³.

Microbiome

With advancements in technologies and methodologies, Microbiome continues to focus on identifying novel microbes, relevant compounds, and enzymes that may be of potential use for a wide array of applications, such as cancer identification and treatments.

The growth of the market is driven by factors such as increased occurrences of lifestyle diseases, leading to increased focus on human microbiome therapies and their respective technological advancements. Specifically, focus has been given to therapeutics targeting cancer and the immune system; tools to help increase the success rate of these therapeutics and microbiome-based products for animal health. As a result, companies developing microbiome-based therapeutics to treat cancer and immune system disorders have the greatest potential to grow rapidly in the short term²⁴.

While there is a high cost associated with clinical trials, there is a growth opportunity for start-up companies offering tools to increase the quality of data and insights generated²⁵. The match between start-ups finding better tools and large companies providing funding for clinical trials is leading to an increase in the amount of partnerships and acquisitions by large pharmaceutical companies of microbiome-based therapeutics companies.

Microbiome therapeutics and diagnostics companies have collectively attracted a total of over \$4 billion USD in investments to date. The current value of human-microbiome-based products and interventions for diagnostic and therapeutic use is estimated to be between \$275 million USD and \$400 million USD worldwide. The value of products and innovations are expected to further increase to between \$750 million and \$1.9 billion USD by 2024. As such, the North America human microbiome market is expected to reach \$446 million USD in 2025 from \$113 million USD in 2017. This growth has been stimulated by billions of dollars of public and private investment into microbiome-based therapeutics and diagnostics²⁶.

²⁰ 11046_CLSA-Digital-Health-Initiative-Research_Paper_v4.0-CMYK.indd (accenture.com)

²¹ Brochure Portrait (cappgemini.com)

²² Digital Health Tech Vision 2019 | Accenture

²³ Top 10 Digital Health Mergers And Acquisitions Show Trends For 2019 - The Medical Futurist

²⁴ Source: Investing in the Microbiome, The Microbiome: Part 4 | by Carly Anderson | Prime Movers Lab | Medium

²⁵ Source: No Guts, No Glory: How Microbiome Research is Changing Medicine (labiotech.eu)

²⁶ Source: Priorities for the next 10 years of human microbiome research (nature.com)

Diagnostics

One of the goals of the diagnostics sub-sector is to build further integration of information and systems to enhance the ability for personalized patient care.

Growth in demand for diagnostics services is due in part to an aging population and changing lifestyles that are causing an increase in conditions like cancer, diabetes and heart disease²⁷. The unique attributes of each patient and their situation is instilling a more patient-centric healthcare movement in diagnostics, wherein the service providers are held accountable for the outcome, including diagnostic performance, quality of diagnosis, service and adherence to safety standards.

These changes are pushing for advancements such as better integration of information systems to provide a holistic picture of a patient's health, which can lead to increases in the quality of diagnosis and add to the effectiveness of outcomes. As such, there is a need for providing seamless exchange of patient information.

For example, advancements and integration are anticipated between AI and radiology, 3D printing models and education training and patient engagement, diagnostic imaging technology improvements in speed and reliability, automated CT scanners, and cryogen free MRI scanners. All of these improvements and others are driving the growth in the diagnostic sector and efficiencies are being gained in part from the increased levels of the integration of these various advancements²⁸.



Oncology

Oncology is one of the world's fastest growing therapeutic areas. The sub-sector is expected to represent 26 per cent of pharmaceutical sales by 2022, with over a hundred new drug approvals received in 2018²⁹. Oncology spending in China in particular has more than doubled in the past five years, mostly due to increased use of existing branded medicine. However, per capita spending in China remains low when compared to the U.S. – with a rate of \$4.5 USD per person, compared to a rate of \$173 USD. Additionally, the sub-sector is currently one of the most crowded spaces for biopharma, with the oncology pipeline representing 35 per cent of all clinical developments in 2019³⁰.

Oncology is however experiencing changes in the market, precipitated by increased cancer incidence, healthcare budget pressures, increasing pharmaceutical R&D costs, and reduced revenue potential. To address these challenges, the sub-sector is increasingly looking towards the adoption of novel pricing strategies (including outcome-based pricing models, which tie drug price to value), personalized care, innovative business models, technology adoption, and growth opportunities in emerging markets. Specifically, the sector is increasingly focused on continuing to ensure improved health outcomes for patients, while ensuring sustainability in business and operating practices³¹.

On the treatment front, the use of immune-oncology therapies has doubled in the U.S. since 2019. Over the next five years, opportunity exists to broaden and extend cancer treatment responses through key avenues, including: early disease detection, more strategic treatment options, individualized regimen selection, and improved treatment access. As seen with digital health, the sector is seeing a shift away from a 'one-size-fits-all' approach, to increasingly focusing on precision medicine (personalized medicine) to ensure patients are receiving specific care in relation to their unique biological makeup³².



²⁷ KPMG – The Healthcare Diagnostics Value Game. July 2018

²⁸ Key Trends for Diagnostic Imaging in 2018 and Beyond | QEST Global (quest-global.com)

²⁹ Playing-to-win in oncology-Key capabilities-for-success.pdf (mckinsey.com)

³⁰ Playing-to-win in oncology-Key capabilities-for-success.pdf (mckinsey.com)

³¹ The future of oncology: A focused approach to winning in 2030 (assets.kpmg)

³² Cardinal-Health-Oncology-Insights-December-2019-Report.pdf

KEY THEMES

Investors continue to seek opportunities which align with their investment strategy, generate very good returns on investments, and can accelerate their market growth and expansion. Life Sciences continues to be a key growth sector for foreign direct investment (FDI) globally.

Through desktop research, several key themes emerged across the sub-sectors regarding global trends, which will drive investment opportunities. These trends provide insights into areas of interest for investors and therefore potential opportunities for growth for Calgary. As such, any FDI attraction efforts by Calgary should naturally revolve around these themes and should be aligned with the City's strengths. The below table provides an overview of key trends and therefore potential investment opportunities, including:

Trend	Digital Action plan or Strategy
Integration	The above sub-sectors are seeing improved integration of information systems and data sets through cloud services for broader insights and more efficient data management.
Blockchain	Blockchain's immutable and secure properties have led to opportunities for better storage and for sharing sensitive data.
Advanced Technologies	Robotics, machine learning and deep learning, AI, and virtual reality are all making large-scale impacts on the Life Sciences industry in a wide range of applications.
5G	Robotics, machine learning and deep learning, AI, and virtual reality are all making large-scale impacts on the Life Sciences industry in a wide range of applications.
Talent Competition	There is an overall trend towards increased competition for Life Science talent.
Demographics Shifts	Blockchain's immutable and secure properties have led to opportunities for better storage and for sharing sensitive data.
Personalization	Rising prevalence of precision medicines (personalized medical) is driving healthcare to be customized based on DNA information and/or other genome features.
Self-Health	Self-health and consumer control and monitoring is growing. Consumers are increasingly interested in tracking and having real time data on their health, which is growing the use of wearables, hearables, and sensors. Some of this uptake is partially driven by the rising incidence of depression, anxiety, and stress levels.

Table 1 Global Life Sciences Trends

Jurisdictional Examples

As part of the analysis, KPMG explored leading practices in comparable jurisdictions. The jurisdictions were selected based on their comparability with Calgary including size, geography, state of maturity in cluster development, and other non-cost factors. The objective of the analysis was to identify leading practice from each jurisdiction, which could be applicable to Calgary. Jurisdictions assessed include:



Vancouver

Vancouver is well known for robust infrastructure in biotech and R&D, which is supportive in fostering a broader culture of entrepreneurship that continues to drive business start-ups. Vancouver has continued to focus on inclusivity, collaboration, and alignment between the City, economic development organizations, education institutes, provincial support, and others to take on a effort to supporting the broad needs of a growing Life Science sector.

Jurisdictional Success Factors

The following is a cursory view of unique attributes of the jurisdiction's life science sector.

- Sector specific organizations providing support services. Broad province-wide coordinated approach to Life Science support through companies, government bodies, and non-profit organizations.
- Thriving angel investor network, venture capitalist, and private equity support which is critical for capital intensive Life Science businesses to start and grow (\$499 million in venture capital to Vancouver companies, Q1 Q2 2020).
- Niche infrastructure for biotech and R&D that supports smaller organizations' needs (Figure 1: UBC Life Sciences Teaching Laboratories)³³.
- Metro Vancouver alone is home to 62 per cent (693) of the province's Life Sciences businesses³⁴.



Figure 1: UBC Undergraduate Life Sciences Teaching Laboratories. (Diamond Schmitt Architects)

Montreal

Greater Montreal has become one of Canada's leading Life Sciences regions, as the scientific excellence of many Montreal institutions are recognized globally. Beyond Montreal, the province of Quebec as a whole has continued to grow and expand its Life Science sector through other well-known cities, such as Quebec City. With a strong venture capital market within the province, Quebec saw more venture capital dollars invested than anywhere else in Canada, with \$599 million invested in the first half of 2020 alone. This includes investment activity in Life Sciences worth over \$207 million. With a further \$935 million of private-equity dollars invested in the province, Quebec boasted a 60 per cent capture rate of all Canadian private-equity deals . These VC and PE investments, coupled with favourable tax credits and refunds, create a haven for Life Sciences to have access to capital and thrive.

Jurisdictional Success Factors

The following is a cursory view of unique attributes of the jurisdiction's Life Science sector.

- Substantial talent pool with over 27,000 university students in Life Sciences specifically
- 630+ organizations in Greater Montreal; 45,000+ jobs in Greater Montreal within the Life Science and Health Technology (LSHT) sector.
- Government funding programs to spur business start-ups (e.g., seed money) thereby lowering the risks and costs of business.
- Funding into research facilities, educational institutes, and other infrastructure that assists in talent development, attraction, and retention, as well as supports business attraction to utilize the highly specialized infrastructure (Figure 2: McGill University Life Sciences Complex).
- In the LSHT industry, Montreal alone contributes to 79 per cent of GDP, an amount totaling \$4.5 billion out of \$5.8 billion of Quebec's GDP in this sector.³⁹



Figure 2: Life Sciences Complex, McGill University (Decasult Project Management)

³³ Undergraduate Life Sciences Teaching Laboratories | Diamond Schmitt (dsai.ca)

³⁴ Life Sciences in British Columbia: Sector Profile (gov.bc.ca)

³⁵ Reseau Capital, August 2020. H1 2020 VC & PE Québec Market Overview - Réseau Capital (reseaucapital.com)

³⁶ Montreal International Economic Development

³⁷ Greater Montréal: Life Sciences & Health Tech hub (montrealinternational.com)

³⁸ Life Sciences Complex – McGill University, Montreal | Decasult

³⁹ <https://www.montreal-invivo.com/en/sectors/portrait-sectoriel/>

The Denver region's Bioscience cluster is supported by numerous advocacy and support organizations such as incubators, accelerators, and collaborative organizations and facilities. With a highly educated workforce and broad streams of growing funding mechanisms, Denver is poised to experience continued growth. With the shovel-ready greenfield development opportunities available for small and large footprints to vacancies in various other spaces all clustered together, the region continues to draw national attention from new large-scale investments.

Jurisdictional Success Factors

The following is a cursory view of unique attributes of the jurisdiction's life science sector.

- Access to highly educated Life Science talent pool.
- Various funding streams and access to capital to start and grow local businesses.
- Venture Capital of over \$310 million USD in Q1 of 2020 for Life Sciences alone⁴⁰.
- National Institutes of Health (NIH) Funding – this is the largest public funder of biomedical research globally, investing more than \$32 billion USD a year. Denver was ranked 18th in the country for NIH funding support⁴¹.
- Numerous programs/agencies provide seed funding, early-stage funding, and other funding supports.
- State-of-the-art and high-caliber research institutions, universities, and the Fitzsimons Innovation Community (Figure 3)⁴².
- Availability of land and shovel-ready development opportunities.



Figure 3: Fitzsimons Innovation Community, (<https://fitzsimonsinnovation.com/>)

Seattle has unique access to high technology firms that draw in talent and provide significant opportunities for alliances between Life Sciences and technology companies. These partnerships set Seattle apart as an emerging hub. This convergence plays to the strengths of Seattle and Washington as a whole. There is a focus on policy priorities to develop a sufficient workforce to sustain Washington's Life Science industry; support entrepreneurship and start-up mentoring programs; invest in research & educational facilities; and ensure that business, tax, and regulatory policies enable companies to invest in long-term, high-risk R&D programs. These elements have been key to driving growth of the sector.

Jurisdictional Success Factors

The following is a cursory view of unique attributes of the jurisdiction's life science sector.

- The University of Washington was ranked as the #1 most innovative public University for three years in a row. This was due to strong access to innovative and entrepreneurial talent within Washington State University and the University of Washington.
- The universities have launched more than 200 start-ups that leveraged their research outcomes.
- Seattle is ranked as the seventh most educated large city in the US.
- Funding from National Institutes of Health (NIH), venture capitalists, state funded programs, and local Tech company acquisitions and partnerships, has created a diverse stream of funding mechanisms:
- Q2 in 2020, Seattle received \$613.5 million USD in Life Sciences venture capital funding.
- Seattle institutions landed more than \$830 million USD in funding from the National Institutes of Health (NIH) in 2019, ranking eighth highest nationally⁴³.



Figure 4: University of Washington, Seattle – Life Sciences Building (Perkins+Will Architecture)

⁴⁰ CBRE Names Denver-Boulder Market a Top Life Sciences Hub | Mile High CRE

⁴¹ CBRE Report – Leading Life Science Cluster Booms: The Bio-Boom Intensifies (2020)

⁴² Fitzsimons Innovation Community <https://fitzsimonsinnovation.com/>

⁴³ CBRE Report – Leading Life Science Cluster Booms: The Bio-Boom Intensifies (2020)

LEADING PRACTICES

Success for many of the jurisdictions is likely built on sector focus and integrated approaches that are supported by industry organizations and accelerators, governmental organizations, economic development initiatives, universities and research hospitals, and other organizations that coordinate specific activities.

Developing a successful ecosystem to foster Life Sciences naturally must be based on the unique contextual circumstances and assets of the city of Calgary. Therefore, efforts must build off the local context in order to develop relevant strategies.

There is no panacea to cluster development. However, common leading practices emerged from a review of comparable jurisdictions. These elements are outlined in the below table.

Many of the main challenges faced and therefore paths forward are not unlike many other sectors. Aspects such as, competitive tax and business environment, access to talent, access to capital, access to relevant facilities (e.g., research facilities, universities, incubators, etc.), and access to and commitment from government support are important elements to supporting sector development.



Talent

Talent is crucial as firstly there needs to be a base of talent within the jurisdiction as a starting point. Furthermore, there needs to be a steady stream of talent and skills, such as those provided through universities with focused programs on Life Science skills and training and various research institutes and facilities that support the growth of talent and the sector. The talent base is often a key impetus to drive clusters.

Jurisdictions have committed efforts to working with various educational institutes on defining and developing programs that are based on needs and demand from the Life Science communities as well. There are often further investments into universities to not only develop relevant industry needs based curriculum, but to invest in facilities that support the sector, and drive innovation and growth.

As talent development is vital, jurisdictions may even have specific programs or partnerships in place with provincial and federal government agencies to assist in the attraction of talent through international student programs, repatriation campaigns, and immigration programs aimed at easing the in-migration process of talented and skilled workers.

Examples from jurisdictions include:

Vancouver

Working with Canadian 'expat' associations on repatriation campaigns.

Montreal

With eight higher education institutions that offer Life Science and Health Technology programs in Montreal, the Life Sciences sector leverages this accessible talent pool, of which receives over \$1 billion in funding dedicated to university research.

Denver

Denver positions itself as one of the best locations to access the graduates coming out of the top Life Sciences programs in the US, which develops, attracts, and retains a high-quality talent pool that is attractive to the Life Science sector.

Seattle

Culture of entrepreneurship and innovation is supported, as seen between Washington State University and the University of Washington who have launched more than 200 start-ups that leveraged their research outcomes.

Collaboration

Collaboration is a fundamental element of any growth and expansion strategy. Whether with private companies, government entities, non-profits, public-private partnerships, or other industry associations, the need for partnerships and collaboration is critical. Each of the jurisdictions reviewed had various relationships in place – ranging from working relationships with universities and private organizations on program and talent development, to joint programming for capital attraction efforts.

Efforts that take on a shared leadership approach between the private sector and government can prove to be effective. The private sector has access to key resources, such as investment capital, technology, markets, supply chains, expertise and know-how. On the other hand, government helps the enabling environment with tax rates, programs, infrastructure investments, higher education funding, and various programs.

Examples from jurisdictions include:

Vancouver

LifeSciences BC (LSBC) is a not-for-profit, non-government, industry association that supports and represents the Life Sciences community. LifeSciences BC undertakes numerous activities to support the sector, such as public policy initiatives that require ongoing and consistent collaboration with both the Government of Canada and the Province of British Columbia.

Montreal

Montreal InVivo, represents the Life Science and Health Technology (LSHT) cluster of Greater Montreal. The not-for-profit organization aims to create a business environment that fosters innovation, growth and competitiveness of the public and private organizations specifically in the LSHT sector.

Denver

The Colorado Office of Economic Development and International Trade (OEDIT)'s Advanced Industries Accelerator Programs supports their key industries by providing up to \$150,000 for proof-of concept grants, up to \$250,000 for early-stage capital grants, and \$15,000 matching grants for businesses looking to export to global markets.

Seattle

City of Seattle has created public-private partnerships and made zoning changes as well as transit and utility investments to transform areas into dense, urban neighborhoods, that are employment focused on the Life Sciences and other growth technology sectors.



Effective Relationships

As previously noted, it is critical that Regions work closely with educational institutes to foster talent, and to invest in infrastructure needs that support the growth and expansion of the sector.

These relationships can vary from programming for internships and co-ops with the private sector to partnerships with incubators/accelerators. The private sector provides a critical partner and co-leader in these initiatives. The private sector has a vested interest and helps ensure the sector development initiatives are designed and implemented with their industry input.

Examples from jurisdictions include:

Vancouver

The Campus-City Collaborative (C3), a partnership initiative, brings together the City of Vancouver, and Vancouver Economic Commission (VEC) with all six public sector post-secondary institutions in the city, to create opportunities to develop and retain talented students.

Montreal

Strategic investments in research and health centres such as: McGill University Health Centre (MUHC), CHU Sainte-Justine, Mother & Child University Hospital Centre, Centre hospitalier de l'Université de Montréal (CHUM).

Denver

CU Anschutz Medical Campus – The largest academic health care center in the Rocky Mountain region, nationally recognized as leaders in interdisciplinary teaching, research and clinical facilities. This campus is part of the Fitzsimons Innovation Community.

Seattle

Strategic investments in research and educational institutes to foster talent development and spur on business start-ups.

¹⁹ <https://www.calgarylogisticscouncil.org/projects/calgary-region-inland-port/>

²⁰ Supply Chain Management Services Industry in the US - Market Research Report. Retrieved at: <https://www.ibisworld.com/united-states/market-research-reports/supply-chain-management-services-industry/>

Investment Attraction Approaches

When it comes to investment attraction, while approaches vary, they are built on the foundation of the contextual strengths of the jurisdiction. For example, if a jurisdiction has great infrastructure and research facilities, they promote this as a means to attract talent and business. Strategies are built on competitive strengths and subsequently look for the opportunities to fill any identified gaps. Below are a few noteworthy elements related to developing strong investment attraction approaches:

- Focused efforts with targeting specific markets and with a focus on sub-sectors and niches.
- Leveraging of current talent pool strengths.
- Significant focus on talent development, attraction, and retention.
- Strategies focused on providing access to capital through various funding mechanisms to support start-ups and future development.
- Focused and strategic infrastructure investments.

Vancouver

Works with partners such as Immigrant Employment Council of BC (IECBC) to attract and support skilled immigrants. Having access to a labour pool is key to establish sector development.

Montreal

Montreal International's (MI) talent team helps bolster the Greater Montreal talent pool by facilitating international recruitment, making the immigration process easier and helping attract and retain international students. Understanding that immigration of skilled talent will be crucial to growth.

Denver

The ability to build ground up or reposition existing buildings that are shovel-ready has made the region a target for Life Sciences companies, property developers and institutional investors.

Seattle

Emphasis on policy priorities to support their ecosystem and sectoral needs for talent, entrepreneurship and mentorship, investment in research and educational facilities, and tax reforms.



COMPARATIVE ASSESSMENT

Future growth for Calgary's Life Sciences sector will largely depend on the city's ability to attract investment. Calgary is home to growing start-up and scale-up companies. Continued growth and success for these companies will hinge in part on their ability to catch the attention of investors and capitalize on existing and emerging investment and FDI trends. While opportunities exist to explore tapping into current capital within Canada, given the current state of access to capital in the city as it relates to Life Sciences, it is likely investors will come from abroad.

When it comes to decision-making for Life Sciences investments, the determinants are broad. Investments need to fit company strategy and achieve positive financial results. Based on subject matter expert feedback, in addition to strategy and financial returns, multinational corporations (MNCs) in the Life Sciences sector are also looking for areas with access to a pool of highly skilled talent and a high quality of life for staff within metropolitan areas. These key factors are part of Calgary's strengths.

Additionally, there is an opportunity for Calgary to attract an 'anchor tenant' (a large organization with broad appeal that helps attract further interest to a specific region or location). The 'anchor tenant' was identified as a key partnership and growth opportunity for companies looking to obtain their first buyer, or to scale-up by leveraging partnerships (and therefore existing supply chains) of these organizations. The presence of an 'anchor tenant' – either through relocation or the growth of a local company – is a key element of growth which will help mature Calgary's Life Sciences ecosystem.

Calgary will need to ensure it is competitive against its North American peers to attract investment. Specifically, the city will need to ensure that it is competitive in areas that matter most to investors.

Investment Attraction Trends

Investment attraction efforts are a staple instrument of economic development. However, investment attraction is an increasingly competitive environment, one in which efforts need to be strategic and focused to begin to attain any level of return on investment and in the wake of the new realities, these competitive aspects are likely to increase. Given the complexity and long-term focus of FDI efforts, where communities often do not realize the results of their efforts for a few years and at times longer, resource inputs in the short-term typically outweigh the short-term returns. However, the return on investment for a community when closing larger deals is tremendous, suggesting that a focused and long-term approach that leverages Calgary's life sciences value proposition is critical to success.

The world has been dramatically impacted by COVID-19, with unprecedented level of economic declines in 2020. Along with dramatic decreases in GDP, trade, jobs, among others, FDI has been impacted. In 2020, Global FDI activity fell sharply due to the pandemic and the resulting economic crisis. In its Investment Trends Monitor Report for 2020, the United Nations Conference on Trade and Development (UNCTAD), released in January 2021, stated that global FDI inflows collapsed by 42 per cent in 2020, from \$1.5 trillion USD in 2019 to an estimated \$859 billion USD⁴⁴. This is the lowest level since the 1990s and 30 per cent below FDI levels during the 2008-2009 global financial crisis. The inflow of FDI to North America declined by 46 per cent to \$166 billion USD, with cross-border mergers and acquisitions declining 43 per cent. FDI decline in Canada was lower than most large, developed countries. The decline was largely attributed to a decrease of FDI coming from U.S. MNCs (a reduction of 50 per cent), which are typically a significant source of Canada's FDI inflows⁴⁵.

Regardless of the recent sharp decline from pandemic impacts, FDI is expected to bounce back. FDI is still a powerful mechanism for growth and development and is one instrument that can help Calgary's Life Science sector leapfrog ahead.



Since 2010 and before the pandemic, Canada continuously experienced annual increases in FDI. Over the same time period, Statistics Canada reported the stock of FDI in Canada (a measure of total cumulative value) increased 7.7 per cent in 2019 to \$973 billion CDN⁴⁶. In Canada, the United States represents approximately 47 per cent of FDI stock, with Europe and Asia representing approximately 38 per cent and 10 per cent, respectively (2019).

As a member of the new Canada-United States-Mexico Agreement (CUSMA), Canada offers foreign investors preferential access to a market with a combined GDP of over \$24 trillion USD and nearly 500 million consumers. Furthermore, Canada has 14 active free trade agreements. The agreements include 51 countries and connect businesses within these countries to 1.5 billion consumers and nearly two-thirds of the world's GDP. As such, Canada remains a top 10 destination for global FDI and Canada will continue to be a leading destination for FDI.

The UNCTAD noted the bright spots of FDI opportunities exist with technology and Life Sciences/healthcare sectors. These sectors will likely see continued M&A activity due to low interest rates and increasing market values which create an environment to acquire assets for expansion. Strong deal activity in technology and biopharmaceutical industries is expected to continue.



⁴⁴ United Nations Conference on Trade and Development, Investment Trends Monitor Report, January 2021

⁴⁵ Investment trends monitor Issue 38 (unctad.org)

⁴⁶ Statistics Canada, FDI Stock, July 2020

Calgary's Competitiveness

Investment decisions continue to be made based on quantitative cost measures for factors⁴⁷ such as labour, tax, facilities, transportation and utilities. Qualitative factors are also an important component of investment decisions – particularly within the Life Sciences sector.

Qualitative elements include business environment and intangible factors. Business environment factors include items related to the size of experienced workforce, new inflows of talent, IT and utility and infrastructure among others. Intangible cost factors can include elements such as the ease of doing business, ease of employing workers, innovation and IP, quality of life, etc⁴⁸. Cities with competitive costs that rank highly for business environment and intangible factors are well positioned to garner investment.

Since investment decisions are typically undertaken through a comparative assessment, to understand where Calgary stands in terms of future FDI attraction it is important to assess the city relative to its peers. To assess Calgary's competitiveness, the KPMG City Competitiveness Index (CCI) was utilized. The CCI benchmarks 20 Canadian, 29 U.S., four Mexican and nine global cities against 12 common cost structures and operational requirements important to investors known as "business personas". Business personas are used by the CCI to help capture the most common FDI projects. By concentrating on business operation, rather than industries, business personas also allow for a more customized assessment of city competitiveness. The model applies current business cost data for each city using a set of business operating specifications which produce a comparison of the estimated cost of operating an equivalent facility within each location.



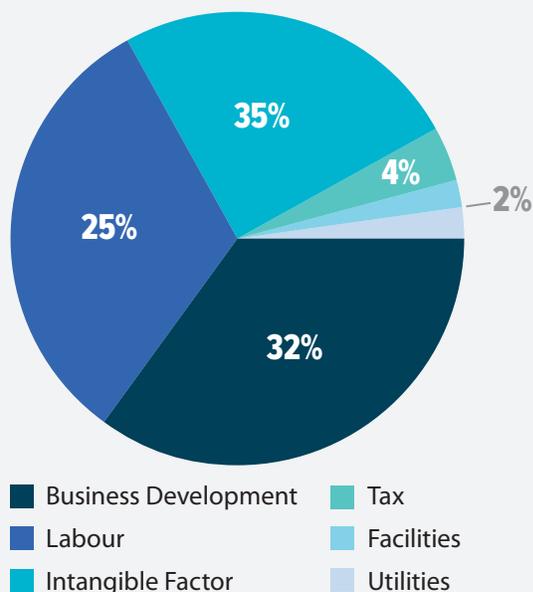
To assess competitiveness within the Life Sciences sector, the R&D (Tangible Products) business persona was used as a proxy. This business persona involves applied research and can apply to R&D operations in fields dedicated to developing tangible products within life sciences. Business operation examples for R&D (Tangible Products) include pharmaceutical R&D, and biomedical R&D⁴⁹. The factors assessed include utilities costs, tax costs, facilities costs, labour costs, business environment factors, and intangible factors. These costs are then weighted based on an average of their relative importance across all featured cities within the CCI. For R&D (Tangible Products), business environment factors are the most important element impacting a city's attractiveness for R&D operations (35 per cent of overall weightings). For R&D, labour costs are the second most important cost factor (32 per cent), and intangible factors are the third most important factor (25 per cent)⁵⁰.

Calgary was compared against those identified in the jurisdictional analysis, including Vancouver, Montreal, Denver, and Seattle. Additionally, major North American cities (such as Boston) were selected to serve as reference points against recognized Life Sciences centres and growing ecosystems. Focus was given to North American cities as investors most often look to a specific part of the world when looking to invest or expand their operations.

The jurisdictions assessed include:

VANCOUVER Canada	TORONTO Canada
MONTREAL Canada	SEATTLE USA
DENVER USA	MINNEAPOLIS USA
BOSTON USA	HOUSTON USA

WEIGHTINGS ACROSS COST FACTORS & ADDITIONAL ATTRIBUTES



Source: KPMG City Competitiveness Index

⁴⁷ KPMG City Competitiveness Index. <https://citycompetitivenessindex.kpmg.ca/home>
⁴⁸ KPMG City Competitiveness Index. <https://citycompetitivenessindex.kpmg.ca/home>

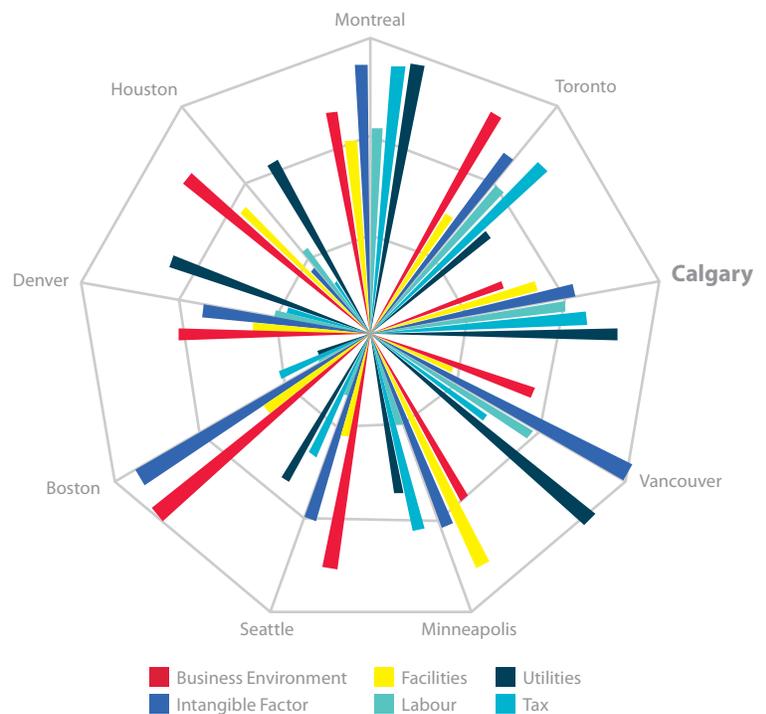
⁴⁹ KPMG City Competitiveness Index. <https://citycompetitivenessindex.kpmg.ca/home>
⁵⁰ KPMG City Competitiveness Index. <https://citycompetitivenessindex.kpmg.ca/home>

Findings

Calgary ranks third overall across all factors against the North American cities listed above with respect to the R&D Tangible Products business persona. This indicates Calgary is competitive across jurisdictions in its potential to attract investment relevant to Life Sciences.

Within other business personas applicable to the Life Sciences sector, including system Assembly and Manufacturing, and Technology Intensive Manufacturing, Calgary has strong performance in some areas. For example, the city ranks first for transportation costs among the selected North American for both business personas.

Within the Distribution Centre business persona (the process of delivering goods from one location to another, including storage, unloading, and unpacking), an important component of the Life Sciences ecosystem, Calgary ranks well in overall competitiveness among North American cities. Compared to North American cities assessed, the city ranks 1st for tax costs and second for labour costs in terms of distribution centres.



Source: KPMG City Competitiveness Index

Overall Rankings for R&D (Tangible Products) – Comparable Select Cities in North America

#	City	CCI Score ⁵¹
1	Montreal	52.28
2	Toronto	52.22
3	Calgary	49.81
4	Vancouver	48.67
5	Houston	46.91
6	Boston	45.42
7	Seattle	43.52
8	Minneapolis	42.84
9	Denver	41.49

Across specific cost factors, Calgary ranks second in competitive (lower) labour costs, following Montreal. First and second position are however only marginally different, with the average total cost per employee (which includes a combination of base salary and benefits across positions/roles) in Montreal being \$113,000 and \$116,000 in Calgary. Calgary is also competitive in terms of facilities costs (fourth), utilities costs (third) and tax costs (third) for R&D (Tangible Products).

The graphic below denotes the competitiveness of each city assessed for each competitiveness factor. The best possible rank is found at the furthest outer perimeter, with the worst possible performance found within the centre of the graphic. As size of experienced workforce and market size are elements assessed under the business environment factors, a city's size does impact its rankings for this factor.

As Calgary continues to grow its Life Sciences sector, promoting its favourable Life Sciences cost environment – such as the city's R&D (Tangible Products) labour, facilities, utilities costs, and tax costs relative to its peers – will be critical to attracting investment. This promotion should be supported by data and information to ensure investors have the necessary information to make their investment decisions.

Additionally, all the Canadian cities assessed outperform their American counterparts. As Canada collectively moves towards growing its Life Sciences capabilities, there is an opportunity for the country's emerging Life Sciences hubs to collectively promote awareness of investment opportunities in the country. Calgary can seek out these opportunities and ensure that the city benefits from national promotional efforts.

In addition to quantitative metrics, qualitative factors are an important element to growing Calgary's Life Sciences ecosystem. The sector is largely comprised of sought-after highly skilled talent. Qualitative factors, such as a high quality of life are an important element to attracting and retaining this talent. As stated in Part A, R&D institutions are a critical aspect of a strong Life Sciences ecosystem, as is the talent within them. For example, the University of Calgary's Innovation Quarter has contributed to a 75 per cent increase in start-ups in the city.⁵²

Calgary is ranked the most livable city in North America and the fifth most livable city in the world.⁵³ The city ranks highly in terms of leisure activities, including having the most extensive outdoor pathway and urban bike network in North America and having over 1,000km of regional pathways. Calgary also ranks as one of the top global cities for family friendliness and has one of the easiest commutes of any major Canadian city⁵⁴. Promoting the city's high quality of life is an important element of attracting not only investment but potential companies and skills to the city.

⁵¹ The highest possible CCI score for the CCI is 100. The score is developed using KPMG's Competitive Alternatives Cost Model (CACM) which analyzes costs for many different types of business operations across multiple geographic locations.

⁵² University of Calgary, 2021. https://ucalgary.ca/about/our-organization/economic-impact?utm_source=economic-impact&utm_medium=redirect&utm_campaign=redirect

⁵³ Calgary Economic Development. <https://calgaryeconomicdevelopment.com/research-and-reports/calgary-rankings/lifestyle-calgary-rankings/>

⁵⁴ Calgary Economic Development. <https://calgaryeconomicdevelopment.com/research-and-reports/calgary-rankings/lifestyle-calgary-rankings/>

CALGARY'S LIFE SCIENCES VALUE PROPOSITION

The investment landscape including FDI is increasingly crowded. To ensure growth in the Life Sciences sector, Calgary will need to effectively capture investor attention. To do so, Calgary needs to have a strong value proposition – one which differentiates the city-region from the competition and demonstrates increasing opportunities within its growing ecosystem.

A value proposition is a statement that summarizes an organization's (or jurisdiction's) promise of value to be delivered to potential customers, users, or investors. The goal of a value proposition is to convey an organization's (or jurisdiction's) advantage quickly and clearly.

Effective value propositions are:

Relevant

demonstrating the benefit or need the organization or jurisdiction is addressing;

Clear

articulating key messaging in a manner that is easy to understand;

Distinct

highlighting what sets the organization or jurisdiction apart from its competitors; and

Succinct

conveying key messaging quickly to the potential customer or user.

An effective value proposition will help attract further investment to Calgary by highlighting the city's unique strengths compared to its peers. To identify Calgary's value proposition, insights were drawn from Part A of this study. The value proposition was developed with Calgary's key strengths in mind as well as the key elements that would be of interest to Life Sciences investors.

Calgary's Life Sciences ecosystem is expanding and innovative. Precipitated by emerging local companies and highly skilled talent, investors have an opportunity to be part of this dynamic and growing sector developing products and services for world markets.

Calgary's assets are distinct. Top-tier institutions, such as the International Microbiome Centre – the world's largest germ-free facility – and the Calgary Cancer Centre – the second largest in North America once completed – are leading the way in internationally recognized research and development. Homegrown start-ups are at the forefront of turning these insights into tangible diagnostics, digital health, oncology and microbiome solutions within Canada's largest and only province-wide integrated health system. University programs, such as the University of Calgary's Biomedical Engineering Program, help provide the sector with the necessary Life



Sciences-related skillsets across the Calgary-Edmonton corridor. Calgary is ranked as the fifth most liveable city in the world due to affordability, access to recreational opportunities and diversity – ensuring the City continues to attract and retain top-tier talent.

Growth in the sector is enabled by Calgary's ability to access national and global markets. Calgary has competitive logistics and distribution advantages – including linkages to the rest of Canada, the United States and Mexico – which support cold chain distribution. Furthermore, Canada has 14 active free trade agreements covering 51 countries, connecting businesses to 1.5 billion consumers and nearly two-thirds of the world's GDP.

Calgary's economic landscape is changing, and Life Sciences is at the forefront. The time is now for investors to benefit from what the City has to offer.

