PERSPECTIVE

Life Sciences in Quebec: A Booming Industry

The life sciences encompass a number of activities. This sector has undergone major changes in recent years, and it holds promise for a number of important developments. Quebec is fertile ground for the industry, mainly because of its reputation in certain areas of research, the quality of its teams and the training programs it offers. That said, the life sciences are subject to certain constraints that could limit their development: the scarcity of skilled workers, competition with very deep pockets, trade wars and the difficulty of bringing discoveries to market, to name just a few. This is an industry that will continue to evolve only if there is a sustained effort to support it. It also requires patient capital. And all the players angling to advance in this space will have to be willing to put in the work needed over the long haul.

Who and What?

What is the reality behind the term "life sciences"? It is broad term that encompasses a large number of things. Many people, and just as many companies, are working on this issue. A quick glance at table 1 on page 2 reveals that some have a more fluid definition than others of what this means. In terms of jobs, the number of workers estimated to be working in this industry is between 18,000 and 56,000 (i.e., triple), depending on the source and the sectors selected. The number of companies operating in this sphere goes from 360 to 650—almost double—based on the headcount done by the organizations themselves and the activities taken into account. At a minimum, this sector includes pharmaceutical companies and biotechnology companies. But it is easy to see that including or excluding public research centres, pharmaceutical wholesalers and equipment manufacturers would skew the statistics.

Regardless of the sub-sectors selected, all life sciences companies are facing the same challenges. These include recruiting labour, prospecting for investments, marketing discoveries and applying new knowledge and developments in the health network and in daily life. While not a comprehensive list, these are the most frequently raised challenges.

The industry definition we will use is the one adopted by the Ministère de l'Économie, de la Science et de l'Innovation, as it is neither too restrictive nor too broad. Based on this breakdown, the life sciences consist of three separate areas of activity.

The first is biopharmaceuticals, which on its own comprises four different types of activities (table 2 on page 2).

In 2016, there were 190 businesses and 16,900 employees in the biopharmaceutical industry. This includes innovative pharmaceutical companies, or those that manage the process of developing a new drug—from research to marketing. These companies hold patents on the products they have developed. Their names are well-known: Pfizer, Sanofi and Merck, for example. Next are generic pharmaceutical companies and contract manufacturing companies, which develop, manufacture and market their own generic products. Some contract manufacturing companies work as subcontractors, offering their pharmaceutical production services to other companies.

For their part, biotechnology companies dedicate most of their efforts and spending to R&D, and see to the development or management of the intellectual property associated with a product, platform or process involving human or animal health.[1] These companies are usually smaller than pharmaceutical firms. About 60 companies, operating mainly in the area of health, were active in this sphere in 2016. Some biotechnology companies in Quebec focus primarily on the environment or agriculture, for example; these companies are not taken into account here.

A Deloitte study carried out for BioQuébec[2] and Pharmabio Développement[3] highlighted the characteristics of what are

[1] Ministère de l'Économie, de la Science et de l'Innovation.

[2] Quebec network of biotech and life sciences companies.

[3] Sectoral workforce committee for Quebec's pharmaceutical and biotechnology industries.

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TABLE 1
The Life Sciences Industry in Quebec

SOURCE AND DATE OF DATA	NUMBER OF BUSINESSES	NUMBER OF JOBS	SECTORS AFFECTED
Ministère de l'Économie, de la Science et de l'Innovation (MESI) – 2016	457	25,390 employees	Biopharmaceuticals Medical equipment Natural health products
2017–2027 Québec life sciences strategy – 2016	630	30,800 industrial jobs	Pharmaceuticals Biotechnology Contract research Contract manufacturing Medical technology and health information technology Natural health products
Investissement Québec – 2018	More than 450	25,400 employees (more than 10,000 researchers)	Pharmaceuticals Health biotechnologies Contract research Medical technologies and manufacturing
Pharmabio Développement – 2017	364	18,000 jobs (14,000 excluding wholesalers)	Pharmaceutical products and medicine manufacturing R&D services in life sciences Pharmaceutical products and supplies wholesalers
Montreal InVivo – 2017	About 650	56,119 jobs	Private businesses Supplier chain Public research centres

Sources: Ministère de l'Économie, de la Science et de l'Innovation, 2017–2027 Québec life sciences strategy, Investissement Québec, Pharmabio Développement, Montreal InVivo and Desjardins, Economic Studies

TABLE 2
Life sciences at a glance – 2016

SUB-SECTORS	NUMBER OF BUSINESSES	NUMBER OF JOBS
Biopharmaceuticals Innovative pharmaceuticals Generic pharmaceuticals Biotechnology companies Contract research organizations	190	16,900
Medical technology companies and health information technologies	151	6,360
Natural health product companies	115	2,130

Sources: Ministère de l'Économie, de la Science et de l'Innovation and Desjardins, Economic Studies

often referred to as "biotech companies." They are described as innovative. At the same time, they have difficulty marketing their products. Box 1 on page 3 is taken from the study and classifies health biotechnology companies into three subsets, based on their current phase of development. This portrait shows that these companies require patient capital. The study notes that several million dollars are invested before any initial revenues are generated. In fact, more than a decade can go by from discovery to marketing.

The last category in the broader biopharmaceutical subset is contract research companies, which are involved in each phase of the product development process, from "in-vitro" to the clinical phase. In 2016, Quebec had about 50 companies in this space.

The second largest subset includes companies that specialize in medical equipment, which are sometimes referred to as medical technology and health information technology companies. These companies have a broad range of activities, from design to marketing through the development and manufacturing of physical, but also digital, medical products. The end products are all types of tools (equipment and devices, for example) used for diagnostic, therapeutic and prevention purposes. In 2016, Quebec had 151 businesses with 6,360 employees in this sphere of activity.

The third and final group consists of natural health products. In 2016, Quebec had 2,130 workers in this field employed by 151 businesses. These companies transform natural substances into commercial products (medicinal herbs, dermocosmetic products, nutraceuticals, etc.). Some focus exclusively on production, while others are more active on the marketing side.

It can thus be seen that the wide range of activities in this field extends far beyond the manufacturing of physical products or drugs in the traditional sense. It is light years away from the image of the apothecary concocting medicines in his dispensary. The life sciences industry is booming: technological advances and increased knowledge are literally propelling this industry forward. We can say that they genuinely represent the way of the future.

BOX 1
Biotechs in Quebec: 2016 Snapshot, according to BioQuébec

Three broad categories of biotechs emerged based on the year the companies were founded: startups (less than five years old); companies that were afloat (between five and nine years); and seasoned companies (ten years plus).

Startups
Startups represent 49% of organizations. In terms of the number of employees, these companies have fewer than three full-time equivalents on average. Most generate zero revenues at this point. External financing, mainly in the form of venture capital (54%) and private loans (25%), accounts for an average total of $600,400, which is spent on R&D—their biggest expense.

Afloat
Companies that are afloat account for 22% of organizations. These companies have on average 11.5 full-time equivalent employees. Their average business volume in Quebec is $600,000, generated mostly in Canada outside Quebec (75%). The average external financing, in the form of venture capital (97.4%), was $9.4M, used mainly for R&D. Clinical studies usually take place during this phase.

Seasoned
30% of organizations are in this category. These biotechs have an average of close to 20 full-time equivalent employees and average revenues of $3.9M in Quebec, generated mostly in Quebec (56%). These organizations rely on average external financing of $3.8M from venture capital (44.3%) and angel investors (24.9%), which is used primarily for working capital.

Sources: Deloitte, BioQuébec and Pharmabio Diagnostic

The Structure of the Industry Is Changing

While once there was a time when large pharmaceutical firms and other companies could work in a vacuum on strictly private projects, that era is clearly behind us. The conditions that dictate how the industry has to innovate and produce have changed. The shift from an exclusive model to a more collaborative one had to take place.

A number of factors fuelled this change. For one, consider the increase in research costs due to tighter regulatory requirements. In addition, advances in knowledge mean that mass-produced products are becoming increasingly rare. This point can be illustrated through a simple, if simplistic, image: in this field, as in the clothing industry, a "one size fits all" approach is not a perfect fit for everyone. In terms of drugs, the products available for sale are being purchased by increasingly smaller segments of the population, since they are designed to address specific issues and are thus better at reaching their targets. Amortizing the cost of drugs is becoming increasingly difficult as the number of people treated gets smaller. Another consideration is the selling price of these drugs, which must be accessible for patients and the different insurance plans that cover them, both public and private. In a context where governments are seeking to contain health-related costs, this presents a challenge for the developers of drugs and treatments.

This dynamic meant that pharmaceutical companies had to rework their strategies. That was when the number of partnerships started to grow to mitigate costs (of research and development, for example) and share the risks with others. In concrete terms, the number of private laboratories has fallen, while alliances with public research centres have greatly increased. Some companies are even outsourcing part of their research activities to other companies. According to the Québec life sciences strategy, this new operating method has had a ripple effect, even here in Quebec. In fact, the number of businesses offering R&D and specialized manufacturing services has grown significantly in recent years. A dozen such companies were created in Quebec between 2012 and 2016.

Quebec Is Fertile Ground for This Industry

According to Investissement Québec, more than 10,000 researchers are working in biomedical research centres. Workforce training is also top of mind, with about 10,000 students graduating from health-related programs each year. A host of programs exist, mostly in colleges and universities, to train new workers and researchers. Quebec has more than 20 public and university research centres.

The bulk of activities in the life sciences sector takes place in the Greater Montreal area (between 66% and 80% of jobs, depending on the source). However, research centres and innovative companies can be found outside the Island of Montreal, Laval and the northern and southern suburbs of Montreal. Some are based in the Quebec City area and in Sherbrooke.

In what areas does Quebec's industry stand out? The Québec life sciences strategy has identified a number of strengths (box 2). Quebec enjoys a solid reputation in cardiology, neuroscience, oncology, infectiology, genomics, imaging, digital health, rehabilitation and sports medicine. In addition to these areas of expertise, Quebec is also recognized in the pharmaceutical sector for its ability to produce medicines in small batches, quickly and efficiently.

BOX 2
Life Sciences: The Quebec Industry's Strengths, According to the Québec Life Sciences Strategy

- Cardiology
- Neuroscience
- Oncology
- Infectiology
- Genomics
- Medical imaging
- Digital health
- Rehabilitation
- Sports medicine

Source : Ministère de l'Économie, de la Science et de l'Innovation

Growth Also Tied to the Workforce

Despite the current boom in discoveries and opportunities, the industry is not immune to the dynamics of Quebec's labour market: the scarcity of workers. This is a sector that includes a broad variety of functions, and whose development is closely linked to the quality of a specialized workforce. In addition to scientists, we also need to recruit specialists in marketing, management, commercialization, computer science and engineering, to name just a few areas of expertise. According to the Pharmabio Développement assessment published in 2018, the industry has fewer workers aged 55 and over than the average in the workforce. And yet the aging of the workforce is still a problem, and the lack of graduates makes some positions particularly difficult to fill. This is especially true for lab technicians and chemists.

In the next three years, an estimated 2,250 jobs in the pharmaceutical and biotechnology industries will need to be filled, or just over 700 per year.

This sector's rapid development also requires upgrading knowledge. The sectoral assessment of the workforce shows that 70% of the companies that responded to the survey believe that at least one job will require training in the next three years. This is significantly higher than the Quebec average for all sectors combined, which is estimated at 45%.

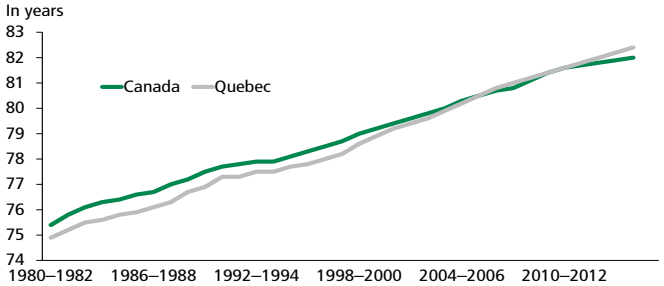
Funding Fuels This Industry

As previously mentioned, the industry needs patient capital: it takes time to turn research and laboratory discoveries into practical applications, or even day-to-day care. Since this sector has been identified as an area with high development potential, the different levels of government have invested in recent years to help it flourish. Across Canada, support comes in a variety of forms, from funding agencies (e.g., Business Development Bank of Canada, Canada foundation for Innovation, Genome Canada) to research centres, strategies and programs (innovation superclusters, Networks of Centres of Excellence, etc.) and foundations. Quebec recently adopted its 2017–2027 Québec life sciences strategy. Quebec will inject $205M in funding over the next five years, with an additional budget of $151M planned thereafter. Efforts will focus on research, support for business financing and job creation. Attracting new private investments is yet another objective.

Encouraging Outlooks

Are the life sciences really the way of the future? They are indeed, for several reasons. The populations in Canada and Quebec are experiencing modest growth, but growth nonetheless. Life expectancy at birth in Canada and Quebec has been increasing steadily (graph 1), suggesting that demand for solutions to live a longer, healthier life will increase over time. In terms of demographics, in 2018 Canada and Quebec had 2,697,210 and 669,575 people aged 75 and over, respectively. These numbers will more than double in the next 20 years, to 5,835,000 and 1,359,400, based on Statistics Canada projections. In fact, this phenomenon of an aging population will be seen around the world.

GRAPH 1
Life expectancy at birth rose considerably in Canada and Quebec over a period of approximately 40 years



Sources: Statistics Canada and Desjardins, Economic Studies

Studies on the global outlooks for the life sciences industry are positive for the industry, in part because of the rapid growth in global health spending. According to Deloitte, annual spending between 2013 and 2017 was up 2.9%, and is set to increase by 5.4% from 2018 to 2022. But how do we reconcile this idea with the limited capacity of governments to pay? Developing countries can be expected to generate wealth that could be invested in health care, in addition to the already predictable expenditures in long-established industrialized countries. In any case, the capacity to cover these expenses is still constrained, despite growing needs. The study also shows that small companies, those that address very specific niches, are where most new drugs are being developed. In some ways, these companies are the true innovators in this industry. With its many small businesses, and through its efforts to foster innovation and entrepreneurship, Quebec is very much a part of this trend. Quebec also has a strong support network and a host of research and teaching centres. As well, Quebec has a large number of umbrella organizations representing the different industry players to coordinate their efforts and promote synergies.

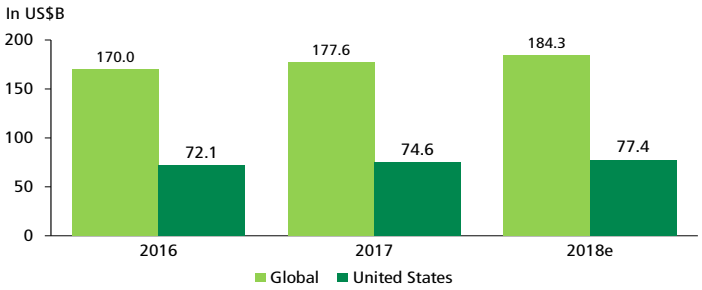
Lastly, industry growth in turn generates demand for specialized equipment and the design of virtual tools. Customized medicines and treatments will also require new physical tools (equipment for care, analysis devices, etc.) and digital tools (diagnostic support, image and data processing, etc.).

The industry seems destined to grow very quickly, but it may have to negotiate a few curves that could cause it to decelerate. These include the ability of governments to pay for health care, which remains limited around the world. Further, the adoption of drugs, treatments and other devices is still subject to regulations that can be tightened based on society's needs (human health, animal health, ethics, the environment, etc.). Trade agreements can be a game-changer, as we have seen with the Canada–United States–Mexico Agreement (CUSMA), whereby pharmaceuticals can keep patents on biological products for ten years instead of eight, as was previously the case. And rising protectionism won't help the industry either—on the contrary. Trade wars do not in any way facilitate trade and they have an adverse impact on supply chains.

The fact that global competition is fierce cannot be ignored. Graph 2 measures the scope of global spending on R&D in the life sciences between 2016 and 2018. An estimated $184.3B—a colossal amount—was spent in the last year alone. The fact that the United States accounts for less than 50% of this amount is noteworthy, as it reflects the contributions Europe and Asia are also making to this industry.

Many things will have to be watched closely in the coming years. The rapid development of customized medicine will disrupt the way companies do business, and the use of artificial intelligence will simply accelerate this change. This will give rise to a host of alliances. In this sharing and collaborative environment,

GRAPH 2
Massive amounts spent annually in life sciences R&D



R&D: Research and development, e: estimate
Source: R&D Magazine Survey

intellectual property and privacy issues are likely to become even more acute. Information security will remain a constant concern, given the nature of the research being done and the massive amounts involved.

Sustained Efforts Need to Continue

Quebec's life sciences industry has been developing for far too long for it to be referred to as a startup in a promising sector. Quebec's industry is already well established, and its expertise in a number of areas has been recognized. We already know that, with the restructuring of large private research labs in favour of much smaller entities, business opportunities have been snapped up over time. Others, however, still remain to be explored. Networking and patient capital are crucial to this industry's development at present. Despite fierce competition and daunting challenges such as labour, protectionism and technological change, many development opportunities remain. Life sciences are shaping our future, and this industry will thrive only if there is a sustained effort to support it. And all the players angling to advance in this space will have to be willing to put in the work needed over the long haul.

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