



**BIOTECHNOLOGY IN BRITISH COLUMBIA:  
ASSESSING THE PROSPECTS FOR CONTINUED GROWTH**

Biotechnology has been defined as “the application of biological knowledge and techniques pertaining to molecular, cellular, and genetic processes to develop products and services.”<sup>1</sup> It is no exaggeration to say that it has the potential to alter every aspect of our daily lives. The decoding of genetic processes and an improved understanding of the workings of cellular structures have opened up almost limitless possibilities to use living organisms or parts of organisms to create a wide range of useful products and applications. Most biotech research and development is occurring in the field of human therapeutics, but advances in biotechnology are also set to transform areas such as forestry and agriculture as well as food processing and environmental remediation.

British Columbia’s growing biotech sector, which is based predominantly in the lower mainland, is positioned to become a significant presence in the North American marketplace. The industry is built upon top-notch research facilities, excellent scientific, medical and technical personnel, and an impressive track record of spinning off companies from hospitals and academic institutions. Yet these solid foundations do not guarantee future success. BC’s biotech “cluster” is still comparatively small in size, and it faces intense competition from other jurisdictions. The well-paid, often equity-

owning knowledge workers that biotech firms employ promise to be an important source of wealth creation for jurisdictions that emerge as biotech leaders. It is therefore not surprising to see governments around the world pouring hundreds of millions of dollars into research facilities and related infrastructure.

Ultimately, only a handful of centres are likely to emerge as true biotech leaders in North America, mainly in the United States. Still, the stakes are also high for “secondary biotech clusters” that can achieve sustainable competitive advantage in a few specialized areas. At this stage, BC should be acting aggressively to reinforce the growth and international recognition of the province’s biotech sector. This means supporting scientific research, establishing a policy framework that encourages investment in both research and product development, and creating an economic environment that nurtures and rewards entrepreneurship and the commercialization of scientific discoveries.

**The BC Biotech Sector**

With the 16<sup>th</sup> largest industry cluster in North America and the 3<sup>rd</sup> largest in Canada, BC is definitely on the biotech map.<sup>2</sup> Biotech is now BC’s most rapidly growing advanced technology industry. According to a number of analysts, the province will soon have the 2<sup>nd</sup> largest biotech cluster in

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<sup>1</sup> Joseph Cortright and Heike Mayer, “Signs of Life: The Growth of Biotechnology Centers in the U.S.,” Brookings Institution Center on Urban and Metropolitan Policy (2002), p. 6.

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<sup>2</sup> BC Biotech, “Biotechnology in BC” (2002), available at [www.biotech.bc.ca](http://www.biotech.bc.ca).

Canada. And biotech is on track to become an increasingly visible part of the Greater Vancouver economy over the coming decade.

Currently, biotech in BC includes over 90 private sector firms plus a number of academic and research institutions.<sup>3</sup> Public and non-profit institutions have played a central role in the evolution of the industry; they include universities as well as organizations such as Genome Canada, the BC Cancer Agency, and the Michael Smith Foundation for Health Research. Health biotech companies dominate the sector, but the province's traditional resource orientation has left its mark on the industry. About 70% of BC biotech companies are involved in biomedical and biopharmaceutical applications, whereas in most other regions of North America up to 90% of biotech firms work in these fields. There is some advantage in having a more diverse biotech sector in the province. Among other things, it may give BC an opportunity to become a world leader in biotech applications that do not receive as much international attention. Another benefit is that non-medical biotech applications are generally subject to less lengthy and less costly regulatory approval processes, so new products can be brought to market sooner.

Biotech in BC is largely "home grown." A strong entrepreneurial spirit, rooted in the province's history of resource development and bolstered by in-migration of talented people, has spurred the industry's development. But the most important contributing factor has been the effectiveness of the province's universities, notably UBC, in creating spin-off companies based on research breakthroughs. Approximately 70% of all biotechnology

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<sup>3</sup> Ibid.

companies in BC have their roots in technologies and therapies developed at universities and teaching hospitals.<sup>4</sup> Without world-class research facilities and scientific investigators, the industry in BC would be a pale reflection of what it is today.

That said, in many respects our biotech sector is still in its infancy. A number of BC companies have reached the point of selling products, some have promising research results and are looking for an equity partner (or to be purchased), but most are still in the costly research and product development stage. No large-scale biotech manufacturing operations exist in the province. Policies designed to promote the sector should focus on enhancing the scientific community that feeds the growing layer of research-based companies, attracting capital from both local and out-of-province sources, and persuading successful firms to stay in BC.

Expanding the research base is important because biotechnology tends to be a time-consuming and risky business. A decade or more can lapse from an initial scientific discovery to the point where a new product reaches the market.<sup>5</sup> In Canada, the government approval process for health-related products takes around two years (double that in the US).<sup>6</sup> Even after years of work and many millions of dollars, the chances of developing a commercially viable product are slim, particularly in the case of pharmaceuticals that must go through rigorous clinical trials. In the field of human health, some 5,500 US patents are awarded

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<sup>4</sup> Ibid.

<sup>5</sup> Andy Hollaway, "Welcome to the Bioeconomy," Canadian Business (September 2, 2002).

<sup>6</sup> This does not include product development prior to clinical trials. Under the three stages of clinical trials products must i) be proven safe, ii) be shown to be effective and iii) have the correct dosage determined. The process adds significantly to product development costs, which average close to US\$500 million. See "Biotechnology in BC," op. cit., p. 17.

each year to researchers and private companies. Yet only about 100 biotech-related drugs have actually reached the market in the past 30 years. And of these, the top ten account for the majority of sales.<sup>7</sup>

The risks and costs of developing new biotech products, particularly in health related fields, make financing difficult. Most private investors have neither the desire nor the capacity to wait for years before any sales revenue (let alone profit) is realized. Early stage biotech investors, typically venture capitalists or individual “angel investors,” may recoup their investment if a company is floated on the stock market or is purchased by a bigger company. Most biotech firms in BC depend on research contracts and/or equity investments from major pharmaceutical companies, which have the financial strength to bear the costs of multi-year research, product development, clinical trials, regulatory approval processes, and marketing.

### **Success Factors and the BC Advantage**

Research and commercialization are the keys to a thriving biotech cluster.<sup>8</sup> The Boston and San Francisco areas – the two largest biotech centres in the US – are both built upon a history of excellent research and have been very adept at converting the fruits of research into commercial activity. In part, this is because they were home to biotech industry pioneers and benefited from “first mover” advantages. In addition, the mix of new research-oriented firms and older, more established manufacturing companies gives these regions a competitive edge. Concentrated research expertise, superb universities, and the availability of local venture funding have served to foster the creation of hundreds of new biotech

companies in Boston and San Francisco. A number of other North American cities that did not necessarily enjoy “first mover” advantages have also been successful in spawning new biotech firms (based on research breakthroughs) and in securing venture capital and research contracts, often with support from the pharmaceutical industry.

So, what characteristics or local traits are most likely to support leading-edge research and expedite commercialization in biotech? Importantly, success seldom comes from excelling in just one area. Most studies suggest that an environment conducive to building a robust biotech sector will have a number of attributes:<sup>9</sup>

- a highly-skilled and appropriately qualified pool of labour;
- an excellent bioscience research base (notably in universities);
- an ability to expand this base by attracting and retaining key staff;
- a well-funded and accessible infrastructure (incubators and research parks);
- a strong entrepreneurial environment;
- the presence of both established local biotech companies as well as a “feeder layer” of smaller, rapidly growing firms;
- competitive business costs;
- a superior infrastructure for clinical trials;
- tax incentives;
- effective networking between the scientific and business communities;

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<sup>9</sup> Adapted from Western Australian Technology and Industry Advisory Council, “Biotechnology West: Strengths, Weaknesses and Opportunities” (December 2000), p. 44; and AT Kearney, “Biotechnology in Berlin/Brandenburg” (2001), p. 7.

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<sup>7</sup> Cortright and Mayer, “Signs of Life,” op. cit., p. 9.

<sup>8</sup>Ibid.

- a favourable regulatory and political environment; and,
- access to venture capital.

**Table 1**  
**BC is Cost Competitive in Biotechnology**  
(estimated annual business operating costs\*  
with C\$=\$0.65US; Vancouver = 100)

*Biotech research and development:*

Vancouver	100
Portland	132
San Diego	141
Seattle	144

*Biopharmaceutical manufacturing:*

Vancouver	100
Portland	117
Seattle	124
San Diego	129

\*Operating costs: labour, materials, supplies, overhead, and non-income taxes.  
Source: Ministry of Competition, Science and Enterprise.

Greater Vancouver, which is home to most of BC’s biotech industry, fares reasonably well on most of these criteria. It is renowned for its quality of life; the province’s education system provides a steady flow of qualified workers; research and development tax credits and recent federal and provincial income tax cuts have made BC more competitive for both technology companies and highly skilled employees; the region has a solid entrepreneurial tradition; and effective networking between the research community and business has contributed to successful commercialization.<sup>10</sup> Another factor that

<sup>10</sup> The Vancouver area registers more US patents than any other region in Canada. Vancouver Economic Development Commission, “Vancouver: A North American Biotechnology Centre” (October 2002).

should continue to promote biotech activity is the province’s excellent infrastructure for conducting clinical trials.<sup>11</sup> Finally, business costs, especially for research-focused firms, are quite low in Vancouver compared to major metropolitan centres in the United States (see Table 1).<sup>12</sup>

Despite these competitive strengths, biotech in BC faces challenges. Perhaps the most serious is the availability of capital. Most analysts believe there is too little local venture capital to finance growth in the high technology sector, including biotech.<sup>13</sup> This limits the potential of BC firms, and makes it harder to attract companies (and experienced employees) from other regions. Business decision-makers outside of BC may know that the Vancouver region has much to offer, but they also realize that without a well developed local financial infrastructure, it is difficult to build globally successful companies from a BC base. A related concern is research funding. Although BC’s biotech research community arguably has accomplished a great deal with limited financial resources, there is a risk of falling behind other key Canadian and US jurisdictions in research support.<sup>14</sup>

A third issue is the policy and regulatory environment. Some aspects of the business climate have improved in BC, particularly

<sup>11</sup> Evidence of this includes the fact that biotech companies from Calgary frequently come to Vancouver to perform their clinical trials, citing better quality infrastructure and significant cost savings.

<sup>12</sup> KPMG, Competitive Alternatives: Comparing Business Costs in North America, Europe and Japan (2002).

<sup>13</sup> Harry Jaako, “A Five Step Process to Revive BC Venture Capital,” Business in Vancouver (September 17, 2002); Michael Volker, “Bridging the Innovation Gap Begins with Startups,” Silicon Valley North (January 2002).

<sup>14</sup> Vancouver Economic Development Commission, “Vancouver: A North American Biotechnology Centre,” op. cit., pp. 10-13.

since the current government assumed office in June 2001. Both individual and business taxes have been reduced, the provincial government is taking steps to boost enrolment and research support in medical and other life sciences disciplines, and – as already noted – business operating costs remain low by American standards. However, for the big pharmaceutical companies that have become a vital source of capital for BC biotech firms, the Reference Drug Program (RDP) and other restrictive policies are a stumbling block – one that in some ways overshadows the benefits that BC has to offer. The Business Council shares the concern voiced by some leaders in the academic and medical communities that the RDP may hinder the flow of investment and research funding from the pharmaceutical industry, and thereby undermine the biotech sector’s growth prospects. And with no local biotech manufacturing base and continuing shortfalls in local venture capital, the pharmaceutical industry has become a crucial source of financial support for biotech in British Columbia.

This is not the place to review the RDP, but a few background points are worth noting.<sup>15</sup> The RDP was introduced BC in 1995 as a “Pharmacare” program and has been maintained to help contain the costs of insured prescription drugs. It does not prohibit the use of any specific drug. Rather, the RDP affects the extent to which drug costs will be reimbursed to patients eligible for Pharmacare benefits provided by the BC government. Under the program, the cost of “reference” prescription drugs is

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<sup>15</sup> See “Report of The Reference Drug Program Consultation Panel” (April 2002), and “Reference Drug Program: Analysis and Alternatives: Submission to British Columbia’s Reference Drug Program Review from Canada’s Research-Based Pharmaceutical Companies” (February 2002) for a more complete discussion of the RDP.

fully paid by Pharmacare. Doctors and patients may choose a more expensive drug not on the formulary, but the patient must pay the difference. Where medical reasons warrant (such as side effects or limited effectiveness of a drug), a doctor can request a Special Authority from Pharmacare to prescribe a different, likely higher cost, drug. But usually this can only be done if the patient has tried the less expensive alternative and the physician files an official request outlining why the reference drug should not be used. If the Special Authority request is granted, Pharmacare will cover the cost of the drug. Physicians are not compensated for the extra time and effort involved in filing such special requests.

A recent government sponsored report put the annual savings from the RDP at \$12 million.<sup>16</sup> BC is the only province in Canada with this type of program, so the savings here cannot readily be compared with the experiences of jurisdictions. However, it must be noted that the estimated savings are small in relation to Pharmcare’s budget of more than \$700 million per year and represent a tiny fraction of total provincial healthcare expenditures of \$10.2 billion.

The pharmaceutical industry has criticized the RDP because it interferes with the market by pre-selecting the drugs that patients use and results in a costly administrative process to “upgrade.” The program also reduces incentives for companies to develop newer (and usually better) therapeutic treatments in the five drug classes to which the RDP currently applies. Pharmaceutical companies and some physicians also cite concerns that the program has “hidden costs” owing to the fact that patients do not quickly get access to the most medically appropriate drug.

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<sup>16</sup> “Report of The Reference Drug Program Consultation Panel,” op. cit., p.13

**Table 2**  
**Investments in BC by Large Pharmaceutical Companies (1999-2002)**

<b>Company</b>	<b>Initiative</b>	<b>Amount \$C</b>
Merck Frosst Canada	Centre for Molecular Medicine and Therapeutics	\$15 million
Merck Frosst Canada	Arthritis Research Chair	\$1 million
GlaxoSmithKline	UBC Research Chair – Lung	\$1 million
AstraZeneca	Disease Management & Pilot Prog.	\$500,000
Pfizer	Health Heart Society	\$2.3 million
Novartis	Disease Management	\$50,000
Pfizer	Antibiotic Pharmacocon	\$22,000
Aventis	Inflazyme – biotech company	\$143.7 million
Aventis	Inflazyme – biotech company	\$6.9 million
Pfizer	Xenon – biotech company	\$93 million
GlaxoSmithKline	INEX – biotech company	\$57.1 million
Novartis	QLT – biotech company	\$15.3 million
Fujisawa	Micrologix – biotech company	\$31.1 million
Roche	Stressgen – biotech company	\$316 million

Source: Pharmaceutical companies, figures compiled by Merck Frosst.  
Note: investments in biotech companies include upfront investments and milestone payments.

The Business Council believes that the positive economic impact of stepped-up research funding and investment in BC by pharmaceutical companies could relatively quickly offset any direct fiscal savings to government from the Reference Drug Program. Several knowledgeable observers, including the BC Progress Board, have expressed concern that the “absence of harmonized public policy that encourages research investment” is a key reason why BC lags in R&D activity.<sup>17</sup> The Progress Board further notes that “major Canadian pharmaceutical companies are deterred from making research investments in British Columbia due to a health policy that adversely affects the sale of their drugs in BC. Other provinces, such as Quebec, Ontario and Alberta, have harmonized their health and industrial policies to encourage major pharmaceutical research invest-

ment.”<sup>18</sup> BC would be well advised to consider doing the same.

Even with the RDP, pharmaceutical companies have emerged as a significant source of funding for BC biotech companies and universities (see Table 2). It stands to reason that pharmaceutical industry investment would increase over time if the RDP were changed to bring BC’s policies in this area into alignment with those of other provinces.

Government’s desire to control health care costs is both laudable and understandable, particularly in the current fiscal context. Healthcare accounts for about 40% of the provincial budget and there is relentless pressure to spend more all across Canada. Here in BC, Pharmacare is an obvious focus of attention given the rising cost of the program, which in part reflects greater utilization (due to demographics and increased longevity), the introduction of new drug therapies (e.g. treatments for HIV), and

<sup>17</sup> BC Progress Board, “Report of the Panel on Education, Skills, Training and Technology Transfer” (December 12, 2002), p. 14; available at [www.bcprogressboard.com](http://www.bcprogressboard.com).

<sup>18</sup> Ibid.

the development of new drugs to replace existing therapies.<sup>19</sup> It is sometimes overlooked, however, that prescription drugs not only enable patients to live longer and better lives, but also reduce the need for expensive surgical treatments and hospital stays, thereby saving dollars in other parts of the health care system.

### **Policy Implications and Directions**

Biotech is a fast-moving industry whose continued success can help to diversify BC's economy. But the industry today represents only a tiny slice of the overall economy and employment base, and is also small compared to what exists in the leading biotech centres in the United States. Looking ahead, the biotech sector deserves attention from policymakers because of its high growth potential and because significant new wealth and economic activity are likely to flow from the development of biotech products and technologies.

Competition for top notch researchers and funding is and will remain intense. Governments around the world have identified biotechnology as a growth engine and are implementing strategies to build strong industry clusters in their own regions. Singapore is a striking example: in 1999, it designated "life sciences" as its principal industrial pillar and set out to become a world-class life sciences hub. Britain recently established a special task force with a mandate to ensure that it retains its traditional competitive edge in pharmaceuticals. Michigan is using its tobacco settlement money to establish a state-wide Life Sciences Corridor anchored

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<sup>19</sup> It should be noted that drug prices have been essentially unchanged over the past 10 years according to the Patented Medicine Price Index produced by Statistics Canada.

at the University of Michigan.<sup>20</sup> Closer to home, Ontario has set an admittedly lofty objective of making the province the 3<sup>rd</sup> largest biotech community in North America.<sup>21</sup>

The biotech industry's perceived upside potential has also attracted keen interest from agencies involved in economic development. A US survey of 77 local and 36 state economic development agencies found that 83% listed biotechnology as one of the top two targets for industrial development.<sup>22</sup> As many as 41 US states have launched programs to stimulate the biotech sector and are now directing substantial sums of money in support of these efforts.<sup>23</sup>

All of this suggests the BC government should be working to forge a long-term strategic vision aimed at nurturing and expanding the province's existing biotech sector. This should be developed in cooperation with academic leaders and industry participants, and include a careful review of possible initiatives to encourage growth in the sector. Given the research-intensive nature of biotech and the fact that

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<sup>20</sup> The Singapore and Michigan examples come from Dr. Martha Piper, "Life Sciences in BC: A Bridge to the New Economy," presentation to the Vancouver Board of Trade (October 2, 2002), available at [www.boardoftrade.com](http://www.boardoftrade.com)

<sup>21</sup> Report of the Bio Council, "Building Ontario's Biotechnology Corridor" (March 2002).

<sup>22</sup> Cortright and Mayer, *op. cit.*, p.6.

<sup>23</sup> *Ibid.*, p. 6. For example, in Missouri, the governor has signed an executive order to spend \$22 million of the state's tobacco settlement for bioscience-related research next year. Michigan, which was the first state to dedicate tobacco settlement funds for bioscience research, has allocated \$50 million a year over a 20-year period to develop and support the "Michigan Life Sciences Corridor." See Technology Partnership Practice, Battelle Memorial Institute and State Science and Technology Institute, "State Government Initiatives in Biotechnology 2001" (September 2001).

financing has been identified as a challenge in BC, particular attention should be given to how to attract more research support and equity capital. To address the industry's financial constraints on growth, the government could consider ways to:

- increase the supply venture capital in the province;
- give small and early-stage companies more opportunities to raise seed capital through improved tax instruments;
- encourage the creation of alliances between small research firms and established biotechnology and pharmaceutical companies; and
- assist the biotech sector (including post-secondary institutions and hospitals) in securing more federal funding for research in the life sciences.

To widen and deepen the pool of local venture capital, incentives could be structured to attract capital from pension funds and labour sponsored funds, which to date have invested little in biotech. Further reductions in general capital gains taxes

would also have a positive impact on the biotech sector. To encourage alliances and draw more research funding to BC, the provincial government should take a fresh look at its Reference Drug Program and work to “level the playing field” so that pharmaceutical companies doing business in BC are not put at a disadvantage relative to other provinces like Ontario and Quebec.

Some of these initiatives may carry a (minor) price tag. But good economic development policy needs to consider longer-term implications and upside growth prospects; an exclusive preoccupation with small, sometimes transitory, cost savings is rarely the path to enduring economic success. That is especially true when considering an industry like biotech, where the potential is great but most of the economic benefits won't be realized for many years. It is important to generate as much activity in biotech as early as possible if the goal is to build a cluster of sufficient size so that growth becomes self-reinforcing. Experience has shown that in dynamic and rapidly expanding economic sectors, missing out on seemingly small opportunities can prove costly over the long term.

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