BIOTECHS IN QUÉBEC

SEVERAL PROFILES, A SINGLE OBJECTIVE: IMPROVING QUALITY OF LIFE, ONE INNOVATION AT A TIME

An initiative of BIOQUÉBEC 25 ans and Pharmabio Développement

WHAT ARE BIOTECHS?

They use innovative methods and techniques resulting from research in biology, but also from other industries such as engineering science, genetic engineering techniques, IT, and chemistry.

Source: Genopole France, 2016

BIOTECHS AND PHARMAS: ARE THEY ONE AND THE SAME?

Biotechs are often mistaken for pharmas. Even though the lines between the two have blurred over the past decade, biotechs are still most often characterized as:

- using innovative processes and technologies
- relying heavily on basic science
- enjoying numerous cooperative agreements with laboratories
- having difficulty in marketing their products

Sources: Bonhomme, Y. ; Corbel, P. and Sebai, J. « Différences entre 'big pharmas' et 'biotechs' – Qu'en disent leurs brevets ? », Actes de la XIVème Conférence Internationale de l'AIMS, Angers, June 2005
PriceWaterHouseCooper: "Biotech reinvented: Where do you go from here?" 2011

> ***" What I see in the field is small biotechs that work hard to find financing to complete their clinical trials and market their innovations. The role of pharmas has transformed over the years: they now invest in these biotechs to feed their product pipelines, and sometimes even buy them out. "***
>
> - Pierre Falardeau
> President and CEO of Verlyx Pharma inc.

WHAT, EXACTLY, DO BIOTECHS DO?

Biotechnology is cross-sectional; it covers these four divisions:

Human and animal health (treatments, preventive and diagnostic tests)	**Agribusiness** (resistance to disease, productivity)
Industrial and environmental (bioremediation, biofuel, recycling)	**Marine** (treatments, cosmetics, biological sciences)

Source: techtarget.com, biotechnology

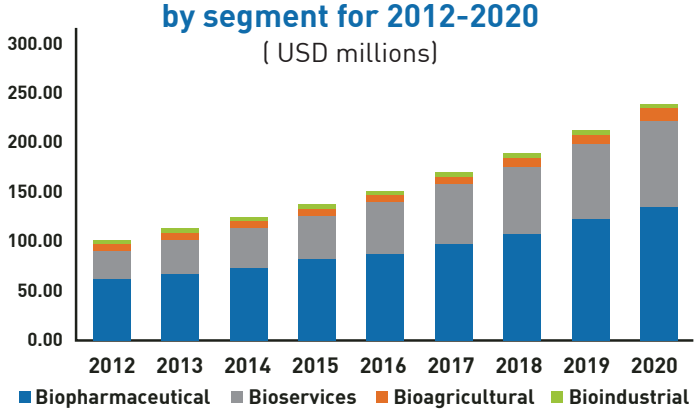
Only biotechs whose products aim to improve human and animal health were part of this study.

Biotechs base themselves on everyday life to find innovative solutions to various challenges to human health and well-being through the use of cutting-edge technology.

BIOTECHNOLOGY, A SECTOR WITH STRONG POTENTIAL FOR GROWTH

The global biotechnology market, estimated at $270.5 billion USD in 2013, is expected to grow at a compounded rate of 12.3% yearly, driven by the search for innovative solutions to prevent, diagnose, and treat conditions such as cancer and orphan diseases.

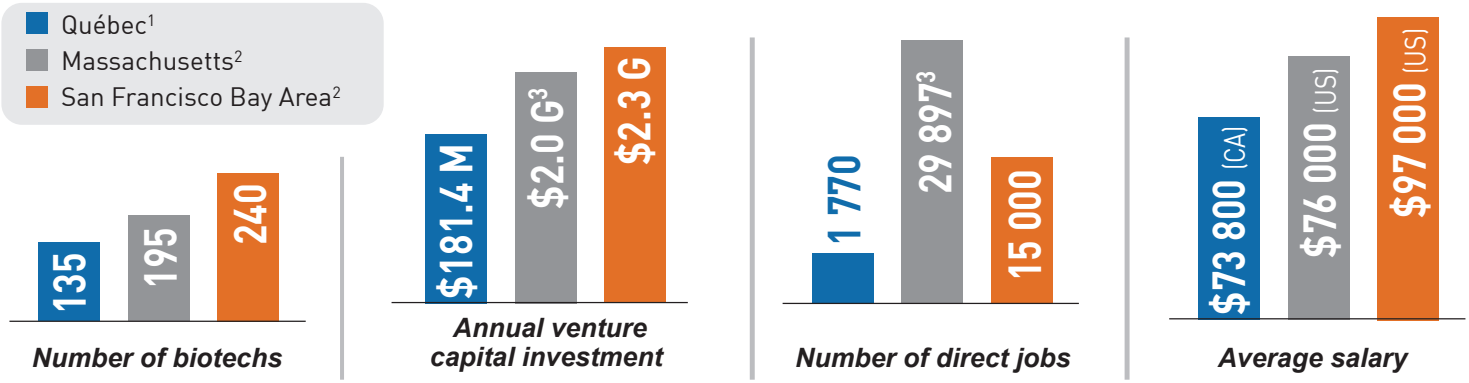
American biotechnology industry by segment for 2012-2020
(USD millions)



Source: Grand View Research, "Biotechnology Market Analysis by Technology (...) and Segment Forecasts to 2020", September 2015

QUÉBEC IS TAKING ITS PLACE AMONG THE GIANTS

It is difficult to compare biotechs from around the world, as their status varies depending on definition, purpose, and sector of activity. Despite these inconsistencies, even a rough comparison of Québec in relation to large international clusters provides an estimate of its share of the globalized biotechnology market.



Sources : **1.** Deloitte. « Sondage sur la biotechnologie au Québec », September 2016 **2.** Paul Diehl. "World's Largest Biotech Hubs: Boston and the San Francisco Bay", The Balance [online], August 2016 **3.** MassBio. "2015 Industry Snapshot", January 2016

NOTE The data for Québec was collected only from those biotechs that met the definition indicated on the first page. If a wider definition would have been applied, as American clusters have done, to include certain contract research firms and medical equipment companies, it is quite likely that the pool of companies would have been comparable to those of the two other regions mentioned; as a result, Québec would be well positioned in the North American market.

STRATEGIC ASSETS ON WHICH TO CAPITALIZE

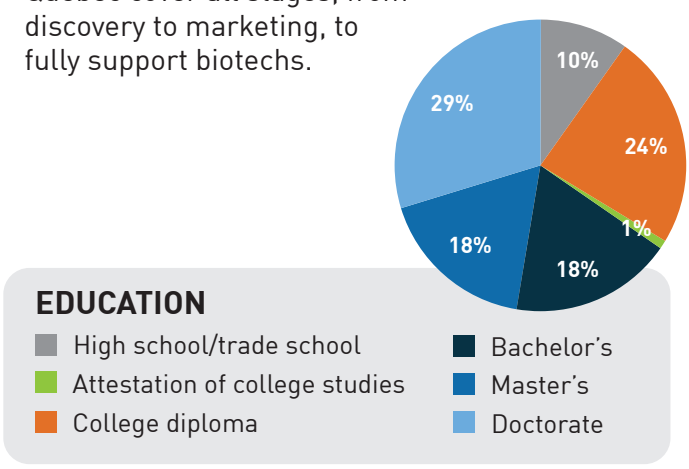
QUALIFIED WORKFORCE

In fact, 65% of employees have graduate degrees, with nearly half of them even holding doctorates.

In 2016, biotechs invested $2.6 million in continuing education. The importance of such training is widely recognized: even 46% of biotechs with payrolls of less than $2 million spent at least 1% of it on education.

A COMPLETE ECOSYSTEM

From educational institutions to intellectual property protection services to contract research firms, the organizations which are part of the innovation chain in Québec cover all stages, from discovery to marketing, to fully support biotechs.

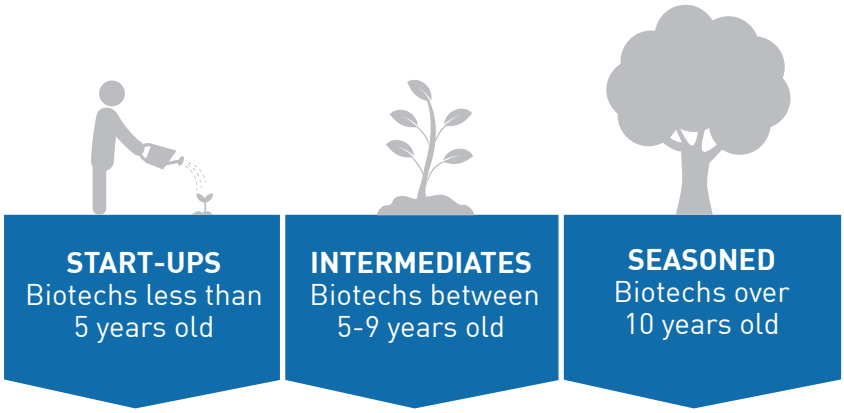


BIOTECHNOLOGY IN QUÉBEC: A STIMULATING SOCIO-ECONOMIC CONTRIBUTION

4 896.8	Number of direct and indirect, full time equivalent jobs created and maintained by local biotechs
$1 million	Injected into the economy by biotechs = representing 8 full time equivalent jobs
$602.9 million	Annual operating expenses, 58.5% of which are incurred in Québec
$468 million	Annual contribution to the GDP, 77% of which is directly paid out in salaries
$155 million	Combined federal and provincial tax revenues
$3.5 million	Added value per biotech
52.6 %	Percentage of total biotech expenses attributable to scientific research and experimental development

BIOTECHNOLOGY IN QUÉBEC: A SECTOR WITH MULTIPLE REALITIES

There is great disparity when characterizing Québec's biotechs, 49% of which have existed for less than 5 years and 30% of which were founded more than a decade ago. This study identified three main groups based on the following characteristics:



	START-UPS	INTERMEDIATES	SEASONED
Prevalence	49%	22%	30%
Type of founder	Entrepreneur	Entrepreneur	Independent researcher
Average number of employees working full time equivalent	2.6	11.5	19.6
Level of education	University degree (98%)	University degree (70%)	University degree (57%)
Percentage of biotechs having had difficulty recruiting	15%	20%	33%
Average annual sales in Québec	$62 900	$600 000	$3 948 900
Source of revenues	Québec (57%)	Canada, hors Québec (75%)	Québec (56%)
Average external financing	$600 400	X 15,7 $9 440 400	/ 2,4 $3 852 900
Types of financing	Venture capital (54%) Private loan (25%)	Venture capital (97.4%)	Venture capital (44.3%) Angel investors (24.9%)
Main reason for financing	Research and development	Research and development	Working capital
Percentage of sector expenses	7%	12%	81%
Main expenditure	Research and development (50.3%)	Research and development (49.5%)	Research and development (53.3%)
Distribution of spending Payroll (P) Research and development (R-D) Lab material and equipment (LME) Training (T)	Québec P (91%) R-D (62%) LME (50%) T (62%)	Québec P (58%) LME (61%) United States R-D (75%) T (75%)	Québec P (65%) United States R-D (42%) LME (42%) T (42%)
Average salary	$33 800	$46 900	$88 700

OVERVIEW OF QUÉBEC BIOTECHS

Québec is teeming with new biotechs

49%

are less than 4 years old

It can take more than a decade for a biotech to go from discovery to marketing! Several million dollars are invested before any initial revenues are generated.

57% of respondents confirmed having shown no revenues in their last fiscal year.

62X an established biotech produces, on average, 62 times the revenue of a start-up.

Companies

AT LEAST 10 YEARS OLD

diversify their workforce to produce and market their discoveries.

A biotech

MORE THAN 10 YEARS OLD

spends, on average, 11 times more than a biotech less than 5 years old.

0 the number of animal health biotechs founded in the past 10 years in Québec; Vetnosis estimates the global market value of this niche will be $33 billion in 2020.

" By improving the health of farm animals, biotechs like ours have a positive impact on human health. Unfortunately, in Québec, business start-up financing programs for this have been abolished and innovation investment funds have dried up. This has created barriers to entry and the situation doesn't improve over time: finding animal health funding is nearly impossible! "

- Michel Fortin, President and CEO of Prevtec Microbia Inc.

$249.2 milion

annual total payroll. Almost one biotech in six does not pay out any salaries. Among those that do, the lowest payroll recorded was $50 000.

74% of biotechs have fewer than 10 permanent employees and

89% have fewer than 25.

$602.9 milion

total annual expenses for the 135 companies polled, with 58% of that amount incurred in Québec.

Animal or production technicians, senior chemists, and sales and marketing experts: biotechs have jobs for you!

MULTIPLYING THE BENEFITS: IT'S BOTH POSSIBLE AND DESIRABLE

A biotech that reaches its 10th anniversary generates, on average, 62 times more sales revenues and 11 times more expenses than a start-up in the same sector. The education of its workforce is diversified and the average salary offered is higher than other companies in its sector. For these experienced businesses, the future is bright: they expect to increase both their capital needs and their number of employees.

It is possible to multiply the benefits by helping young biotechs go from lab to market, from discovery to marketing. BIOQuébec has the following recommendations, some of which match those issued by the Québec government's Life Sciences Working Group, in which BIOQuébec participates:

REINFORCE THE FINANCING CHAIN

ISSUES	OBJECTIVES	EXAMPLES OF SOLUTIONS
■ Creating companies ■ Business survival rate ■ Number of strategic jobs ■ Number of Québec-owned companies ■ Foreign investment ■ Investors' knowledge of life sciences	Having a complete financing chain that will ensure and expedite the growth of businesses in Québec while reinforcing all parts of the financing chain.	Establishing: ■ Seed and start-up funds ■ A $100 million fund dedicated to life sciences focused on growing businesses ■ A tactical and strategic team specializing in life sciences

SUPPORT AND EXPEDITE THE INTEGRATION OF INNOVATIONS

ISSUES	OBJECTIVES	EXAMPLES OF SOLUTIONS
■ Coordinating innovations with the needs of the health and social services network ■ Opening and maintaining dialogue ■ Prioritizing innovations ■ Field and associated investment studies ■ Innovative technology evaluation process	Supporting and expediting pertinent and efficient innovations within the health and social services network by creating the Québec an Office for Health Innovation. Mandating the INESSS to assess promising new technologies, therefore improving the evaluation process.	■ Establishing the Office and hiring its management staff ■ Measuring the impact of innovations ■ Creating a distinct unit at the INESSS ■ Creating environments which foster the development of promising data within realistic contexts of care

INCREASING THE PERCENTAGE OF QUÉBEC-BASED SPENDING

ISSUES	OBJECTIVES	EXAMPLES OF SOLUTIONS
■ Percentage of research and development spending by biotechs operating for 5 years or more occurring outside of Québec ■ Percentage of material and equipment spending by biotechs operating for 4 years or less and 10 years or more occurring outside Québec	Increase the percentage of spending in Québec by favouring relationships between companies within the life sciences ecosystem, such as between biotechs and contract research organizations.	■ Promote local contract research organizations and their specialties to biotechs ■ Promote the partnership between BIOQuébec and Fisher Scientific, which offers BIOQuébec's biotech members 10% to 30% discounts on lab material and equipment

IMPROVING QUALITY OF LIFE, ONE INNOVATION AT A TIME

Biotechs work on concrete solutions like how to improve the accuracy of diagnoses, reduce treatment and recovery time, and increase the efficiency of treatments, to name but a few. Here are some examples of Québec-based biotechs that successfully met the challenge:

A QUESTION OF ANTIBODIES

The traditional method for creating antibodies involves immunizing animals, then extracting the antibodies from their blood.

However, this method has its limitations:

- Generating large quantities of antibodies means using more or bigger animals
- The antiserum obtained contains antibodies from all foreign proteins to which the animal was exposed; it must then be purified
- Limited shelf life

THE EGG IS THE ANSWER

Three Université de Sherbrooke graduates were able to transform chicken eggs into high-quality antibody factories.

Thanks to this innovative method, Immune BioSolutions is able to generate record numbers of specific antibodies in record time, without having to use any actual critters!

IMMUNE BIOSOLUTIONS

Immune BioSolutions
Founded in 2012
Head office: Sherbrooke
Market: worldwide

A DROP OF WATER...

Recently-weaned piglets are more likely to be affected by certain strains of *E. coli* bacteria.

After colonizing the intestines of young animals, *E. coli* F4-ETEC releases the toxins responsible for post-weaning diarrhea (PWD).

Current methods to limit this menace are antibiotics and zinc oxide, but they have their own limitations:

- The bacteria are resistant to antibiotics
- Zinc oxide, a heavy metal, is not environmentally-friendly

... A FLOOD OF RELIEF (FROM A WATER-SOLUBLE VACCINE)

A live vaccine, developed and produced in St-Hyacinthe, is mixed with piglet trough water and as such, immunizes the animals against PWD.

This innovative solution from Prevtec Microbia reduces the use of antibiotics in the prevention and curing of diseases in pigs destined for human consumption.

Prevtec microbia

Prevtec Microbia
Founded in 2003
Head office: Montréal
Market: worldwide

HARD TO PASS...UP

Hospitals are regularly hit by *C. difficile* bacteria epidemics, because patients taking antibiotics have restricted intestinal flora diversity, which creates a breeding ground for the bacteria.

Each episode means that:

- Infected patients have a diminished quality of life
- Treatment is delayed and becomes more expensive
- Additional costs are incurred because of special disinfection teams

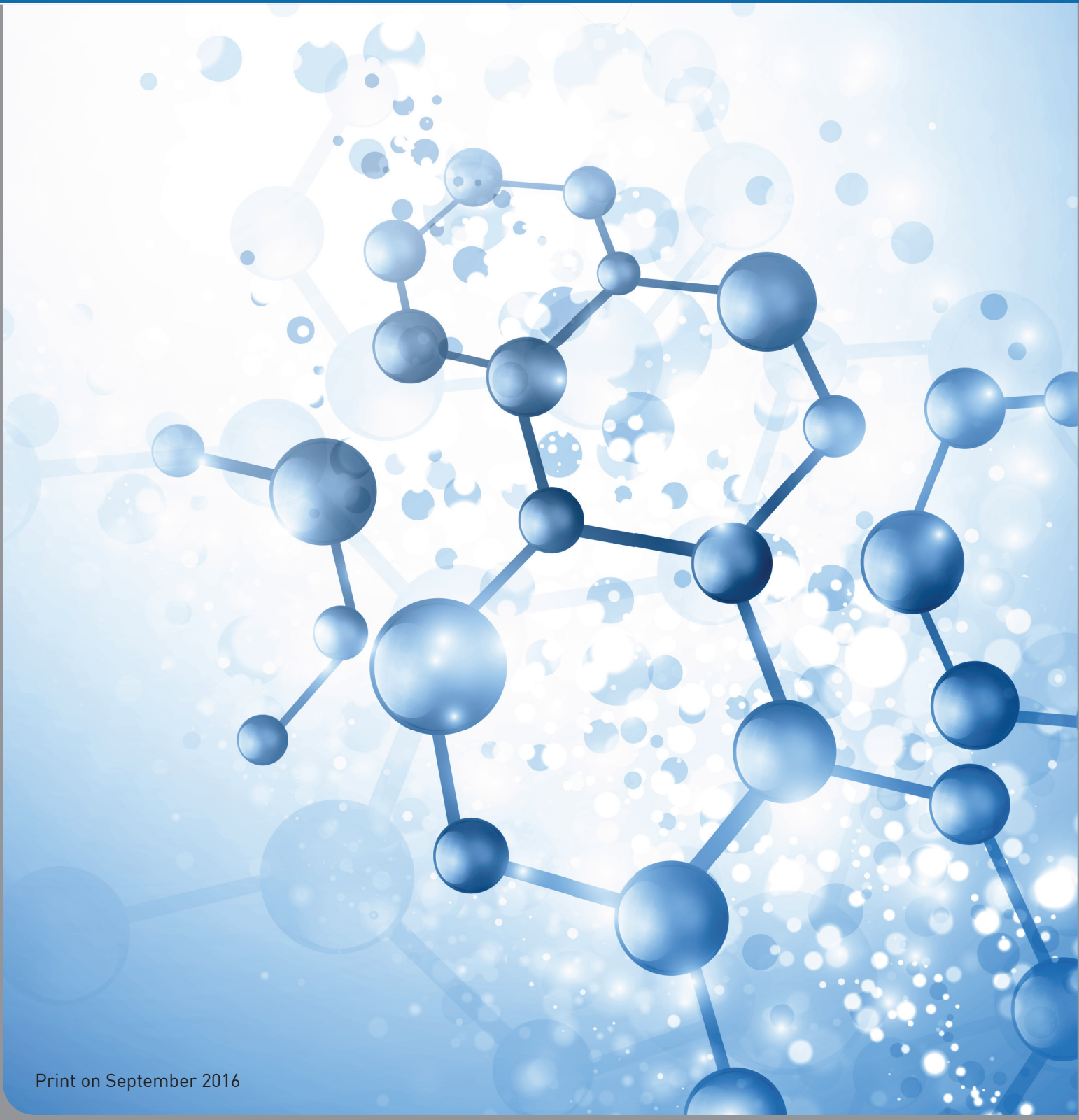
PROBIOTICS TO MOVE THINGS ALONG

To help battle this threat, a Québec biotech targeted the source of the problem: the variety of intestinal flora.

Bio-k + found a way to counteract the effects of antibiotics by re-establishing and maintaining this diversity. Once again outnumbered, bacteria can no longer cause any damage.

Bio-K+ PLUS MD

Bio-K Plus International
Founded in 1994
Head office: Montréal
Market: worldwide



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