Future-Ready: Developing Key Competencies for Canada's Biomanufacturing Workforce

Prepared by
CASTL in partnership with BioTalent Canada and Future Skills Centre

Date: February 2025

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Table of Contents

About CASTL

The Canadian Alliance for Skills and Training in Life Sciences (CASTL) is Canada's national biomanufacturing training partner, dedicated to developing skilled talent to drive the country's thriving biomanufacturing sector. With state-of-the-art, GMP-simulated facilities from coast to coast (in Charlottetown, PE; Montreal QC, and Vancouver, BC), CASTL delivers hands-on, industry-informed training alongside flexible online learning. As Canada's exclusive provider of National Institute for Bioprocessing Research and Training (NIBRT) programs, CASTL offers world-class education with support from adMare BioInnovations and its adMare Academy, shaping the next generation of life sciences professionals.

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About BioTalent Canada

BioTalent Canada supports the people behind life-changing science. Trusted as the go-to source for labour market intelligence, BioTalent Canada guides bio-economy stakeholders with evidence-based data and industry-driven standards. BioTalent Canada, as a workforce development council, is focused on igniting the industry's brainpower, bridging the gap between job-ready talent and employers, and ensuring the long-term agility, resiliency, and sustainability of one of Canada's most vital sectors.

BioTalent™MC Canada

Introduction

Setting the Stage

Canada's biomanufacturing sector is entering a period of unprecedented opportunity, driven by advancements in biotechnology and a growing demand for domestic production capacity. However, the ability to seize this moment relies on addressing a critical need: a skilled and adaptable workforce capable of meeting the rigorous demands of this rapidly evolving industry.

Purpose of the Report

This *Future-Ready: Developing Key Competencies for Canada's Biomanufacturing Workforce* is the first in a series of three reports commissioned by CASTL to address workforce challenges in Canada's biomanufacturing field. This report focuses on the foundational skills, competencies, and training needs identified through research with 50 biomanufacturing employers.

Why This Research Was Done

To meet growing demand, Canada's biomanufacturing industry will require 65,000 additional workers by 2029, including 16,000 for biomanufacturing-specific roles. CASTL initiated this research to identify skills gaps and training priorities, ensuring a prepared and competitive workforce.

A Series of Reports

This report forms part of a larger initiative, with subsequent reports to focus on:

Emerging Technologies:
Skills Development for AI in the Biomanufacturing Workforce: A Path to Innovation

Navigating the Talent Landscape:
Labour Market Information Shaping the Biomanufacturing Workforce

Together, these reports will provide a cohesive and actionable roadmap for strengthening Canada's biomanufacturing talent pipeline.

A Call to Collaboration

To build a sustainable and globally competitive Canadian biomanufacturing field, industry, academia and policymakers must collaborate to align training and education programs with evolving workforce needs. This report serves as the foundation for these collective efforts.

Findings At-a-Glance

Employer Priorities in Talent Development

The foundation of a strong workforce lies in understanding the skills employers value most. Insights gathered from surveys and interviews with Canadian biomanufacturing employers reveal a consistent emphasis on technical expertise and regulatory skills.

Key Skills Employers Seek

1. **Good Manufacturing Practices (GMP)** – Essential for 80% of employers.
2. **Laboratory Skills and Techniques** – Critical for 70%.
3. **Manufacturing and Production Techniques** – Highlighted by 64%.
4. **Documentation and Reporting** – Necessary for 60%.
5. **Hands-on Technical Experience in Regulated Sectors** – Valued by 58%.
6. **Quality Control and Assurance** – Prioritized by 58%.

Training Needs Within 12 Months

- **78%** of employers require introductory training for new hires.
- **62%** of employers highlight the need for similar training for current employees.

Building on Foundations

Employers consistently cite gaps in practical, hands-on skills as a challenge. This underscores the importance of designing programs that bridge theoretical knowledge with real-world application.

Competencies Needed

Biomanufacturing success relies on employees mastering foundational and advanced competencies, enabling them to meet the demands of precision-driven and regulated environments. Employers prioritize skills that directly align with operational needs, particularly for roles that are key to the sector's growth. (See Figure 1., p.10)

Top Roles and Competencies

Manufacturing/Production Technicians

- Account for **35% of new hires**
- Core skills: GMP compliance, process optimization, and production line operation

Laboratory Technicians

- Represent **15% of hiring needs**
- Core skills: laboratory techniques, assay development, and data analysis

These roles emphasize the need for strong foundations in GMP and regulatory knowledge, coupled with practical, hands-on expertise.

"When we say technically trained, that casts a really big net. The technician that's going to run a cell and gene therapy process, or a biotech process, is probably university-educated with a biology degree, or maybe chemical or biochemical engineering or chemistry. They're coming from a science background of some sort like that. Whereas in a pharmaceutical manufacturing environment, a lot of those technicians might just have high school. So, there's a pretty big range and difference between what the pharmaceutical industry needs versus what the biotechnology industry needs, and then what cell and gene therapy specifically needs."

— Industry Representative

Employer Insights

Employers consistently highlight gaps in practical skills and the importance of job readiness:

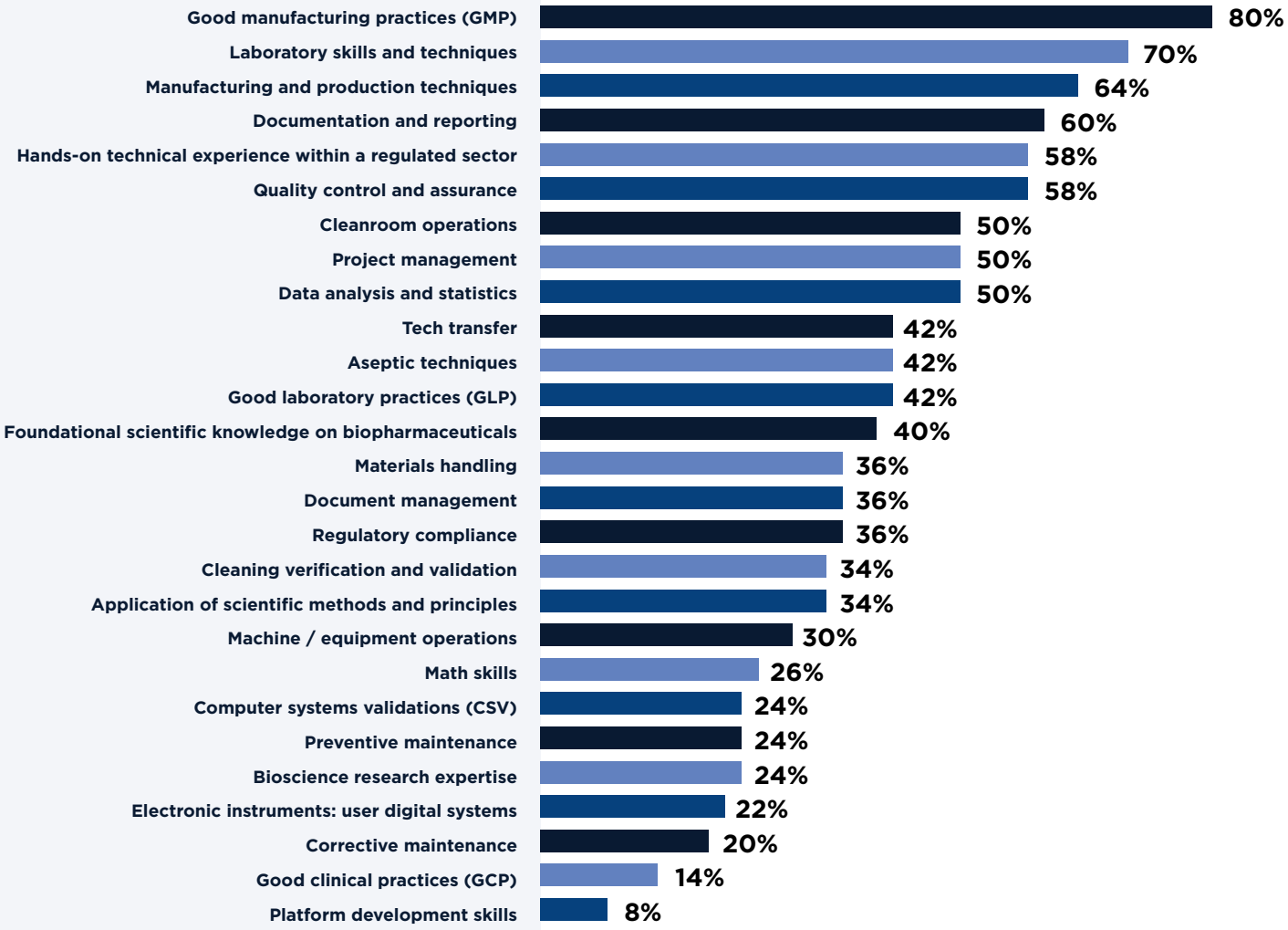
- “GMP knowledge isn’t optional — it’s critical for day-to-day operations.”
- “Graduates come to us with the theory, but they’re not prepared for the realities of production.”
- “We often have to spend months training employees on basics they should already know.”
- “We need staff who can adapt quickly and handle deviations in a regulated environment.”

Addressing the Gap

Practical training programs are essential to bridge the divide between academic preparation and workplace requirements. Employers are calling for hands-on experiences in GMP adherence, cleanroom operations and regulatory compliance to ensure employees are job-ready.

TECHNICAL SKILLS EMPLOYERS LOOK FOR IN EMPLOYEES

Figure 1



Source:
Biomanufacturing Employer Survey (n=50)

Creating a Culture of Training

Overcoming Barriers

While employers recognize the critical role of training in maintaining operational excellence and workforce readiness, many face persistent challenges that hinder implementation. (See Figure 2.) These barriers are particularly pronounced among small- and medium-sized enterprises (SMEs), which often lack the financial and operational capacity to support robust training programs.

Key Barriers to Training

Costs

- Training programs, especially those requiring specialized equipment or external expertise, are prohibitively expensive for many SMEs.
- Employers emphasized the need for affordable solutions, noting that training often competes with other operational priorities for funding.

Time Constraints

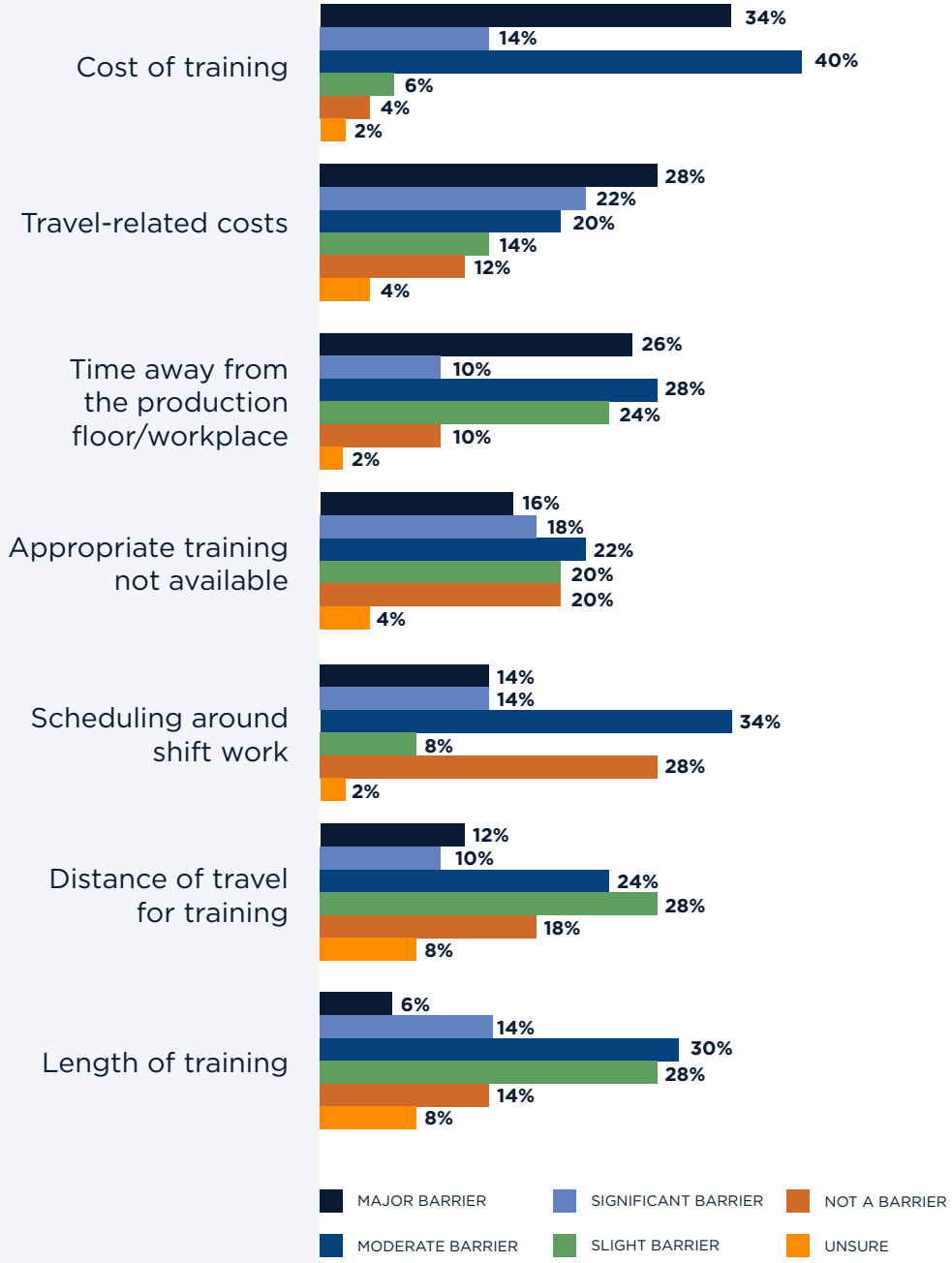
- Balancing training with day-to-day operations is a significant hurdle, especially for organizations operating on tight schedules or with lean staffing.
- Employers reported difficulties in releasing staff for training without disrupting workflows or production timelines.

Availability

- There is a lack of accessible, biomanufacturing-specific training programs tailored to the unique needs of the industry.
- Employers highlighted a gap in programs focused on emerging areas like cell and gene therapy, automation, and advanced quality control techniques.

BARRIERS TO TRAINING

Figure 2



Employer Insight:

"Another big barrier is funding, especially as a new setup. Nobody wants to spend money on training, especially when there's no guarantee of retention."

"One of the barriers that I see is definitely the time and the money for a small startup to be able to train people properly."

"A large barrier among my colleagues is just having the time because their jobs are very busy. There are always problems to solve, so being able to find the time to take the training is difficult, especially if it's something that you'd prefer to do during work hours."

Investments in Training

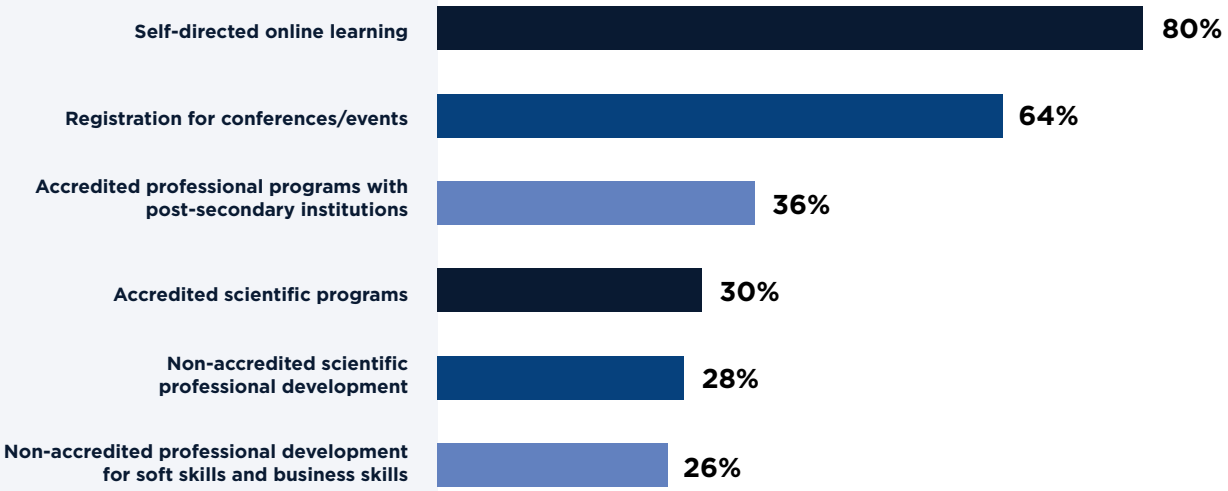
Despite these challenges, forward-thinking employers are implementing innovative strategies to overcome these barriers and prioritize workforce development: (See Figures 3 and 4.)

Self-Directed Online Modules - Employers value these for their cost-effectiveness and flexibility, enabling employees to learn at their own pace without disrupting operations. Online modules are particularly useful for foundational topics like GMP basics and regulatory compliance.

In-Person Workshops - Hands-on training remains the gold standard for technical skill acquisition, with workshops providing immersive experiences in areas such as cleanroom protocols and equipment troubleshooting. Employers noted that these sessions are essential for bridging the gap between theoretical knowledge and practical application.

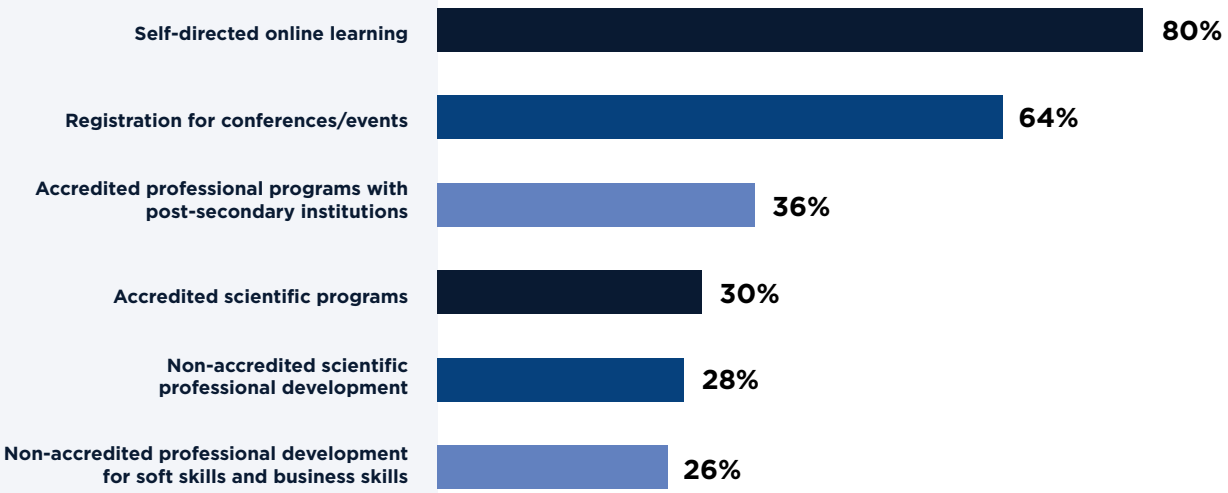
TYPES OF ACTIVITIES INCLUDED IN TRAINING BUDGET

Figure 3



PREFERRED FORMS OF TRAINING

Figure 4



Source: Biomanufacturing Employer Survey (n=50)

Training as a Retention Strategy

Employers increasingly view training not just as a cost but as a strategic investment. By equipping employees with relevant skills and providing opportunities for growth, organizations can enhance job satisfaction, foster loyalty, and reduce attrition rates. This approach ensures a more stable and committed workforce, ultimately benefiting long-term organizational growth and competitiveness.

Employer Insight

One employer captured the broader impact of training succinctly:

“When we invest in our employees’ development, they see a future with us. That’s a game-changer for retention.”

Summary

The Future-Ready: Developing Key Competencies for Canada's Biomanufacturing Workforce report highlights the critical skills, training needs, and opportunities for collaboration required to strengthen Canada's biomanufacturing workforce. The findings outlined in this report underscore the sector's reliance on Good Manufacturing Practices (GMP) and laboratory techniques while calling for innovative approaches to training and workforce development.

Key findings

GMP and Laboratory Skills are Essential

GMP (80%) and laboratory techniques (70%) are critical for workforce readiness and regulatory compliance.

Collaboration is Key

Partnerships between post-secondary institutions, industry and policymakers are essential to align training with real-world demands.

Transitioning Talent from Other Sectors

Workers from adjacent industries like pharmaceuticals and food manufacturing bring transferable skills that can address workforce gaps with targeted reskilling programs.

Recommendations

1. Prioritize Training in GMP and Core Competencies

- Expanding access to hands-on training programs in GMP and laboratory techniques should be a top priority.
- Investments in short, practical courses and simulation-based learning can accelerate workforce readiness.

2. Strengthen Collaboration Across Sectors

- Create stronger partnerships between post-secondary institutions, policymakers, and industry leaders to ensure training aligns with real-world demands.
- Establish initiatives to share resources, develop standardized training programs, and address regional challenges.

3. Leverage Adjacent Talent Pools

- Develop targeted reskilling programs for workers transitioning from other sectors. Short certifications in biomanufacturing basics, cleanroom operations, and quality assurance will equip these workers for success.
- Promote awareness of biomanufacturing career pathways to attract skilled candidates from non-traditional backgrounds.

Looking Ahead

By addressing these priorities, Canada has the opportunity to establish itself as a global leader in biomanufacturing innovation. The findings in this report represent the first step in a broader initiative to strengthen the workforce, with subsequent reports exploring labour market trends and the role of emerging technologies. Collaborative action today will ensure a resilient and competitive workforce for the future.

Gathering the Data

Methodology and Data Sources

The methodology and data sources used for the two components undertaken by BioTalent Canada to support the project were as follows:

1. Employer Survey:

A survey was distributed to 50 biomanufacturing employers across Canada, achieving a purposive sample to reflect a diverse range of company sizes, geographies, and biomanufacturing processes. The survey included mostly closed-ended questions and took an average of 26 minutes to complete.

2. Employer Interviews:

Follow-up semi-structured interviews were conducted with 15 employers, each lasting approximately 45 minutes. These interviews allowed for deeper insights into the survey responses, providing qualitative context and thematic understanding.

Acknowledgements

CASTL extends their gratitude to the 50 employers and other stakeholders who contributed their time and insights to this research. Thank you to BioTalent Canada for contributing to this research.

This study was part of the CASTL-led Knowledge and Insights for Future Proofing Biomanufacturing Training project funded by the Government of Canada through the Future Skills program.

About Future Skills Centre

Future Skills Centre (FSC) is a forward-thinking centre for research and collaboration dedicated to driving innovation in skills development so that everyone in Canada can be prepared for the future of work. We partner with policymakers, researchers, practitioners, employers, and labour groups, and post-secondary institutions to solve pressing labour market challenges and ensure that everyone can benefit from relevant lifelong learning opportunities. FSC is founded by a consortium whose members are Toronto Metropolitan University, Blueprint, and The Conference Board of Canada, and is funded by the Government of Canada's Future Skills Program.

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Canadian Alliance for Skills and Training in Life Sciences
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CASTL

Canadian Alliance for Skills and Training in Life Sciences

adMare Academy Partner

National Headquarters

302-134 Kent Street
Charlottetown, PE
C1A 8R8 Canada

Charlottetown

35 Regis Duffy Drive
Unit 1
Charlottetown, PE
C1E 0K6

Montreal

4100 Molson Street
Suite 120
Montréal, QC
H1Y 3N1

Vancouver

280-3820 Cessna Drive
Richmond, BC
V7B 0A2

castlcanada.ca