

EQUIPPING A NEW GENERATION FOR SUCCESS

Infrastructure funded by the Canada Foundation for Innovation enriches the training environment at research institutions in Canada and helps students and postdoctoral fellows acquire skills and expertise that give them a competitive advantage

FOCUS GROUP REPORT
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What is the Canada Foundation for Innovation?

The Canada Foundation for Innovation (CFI) makes financial contributions to Canada's universities, colleges, research hospitals and non-profit research organizations to increase their capability to carry out high-quality research.

Research supported by the CFI is helping build communities across Canada. That's because the CFI gives researchers the tools they need to think big and innovate. And a robust innovation system translates into jobs and new enterprises, better health, cleaner environments and, ultimately, vibrant communities. By investing in state-of-the-art facilities and equipment in Canada's universities, colleges, research hospitals and non-profit research institutions, the CFI also helps to attract and retain the world's top talent, to train the next generation of researchers and to support world-class research that strengthens the economy and improves the quality of life for all Canadians.

Table of contents

KEY FINDINGS	1
INTRODUCTION	2
RESEARCH INFRASTRUCTURE HELPS ATTRACT STUDENTS AND POSTDOCTORAL FELLOWS	2
DIRECT ACCESS TO RESEARCH INFRASTRUCTURE MATTERS	3
RESEARCH INFRASTRUCTURE CREATES OPPORTUNITIES FOR COLLABORATION	4
ADVANCED INFRASTRUCTURE ALLOWS A NEW GENERATION TO PUSH BOUNDARIES.....	5
ACQUIRING AND REINFORCING SKILLS AND EXPERTISE THROUGH STATE-OF-THE-ART RESEARCH INFRASTRUCTURE	5
GAINING A COMPETITIVE ADVANTAGE TO PURSUE THE CAREER THEY WANT	5
CONCLUSION.....	6

About this report: This report summarizes the information the Canada Foundation for Innovation (CFI) gathered through a series of focus groups that aimed to solicit opinions and experiences from students and postdoctoral fellows currently using CFI-funded research infrastructure. The CFI worked with research offices from 11 institutions to organize the in-person discussions that involved people from a range of programs, disciplines and areas of research across Canada.

Key findings

CFI investments in research infrastructure enable universities, colleges and research hospitals to create state-of-the-art training environments where students and postdoctoral fellows develop in-demand skills and expertise that provide them a competitive edge when pursuing further education and employment.

CFI investments in research infrastructure enrich the training environment for students and postdoctoral fellows at research institutions across Canada.

- Students and post-docs, many of whom were familiar with the CFI, reported that the availability of research infrastructure influenced where they chose to study.
- Many commented on the importance of research infrastructure in creating opportunities to collaborate and interact with researchers in other departments within the institution and at other universities, along with private companies, other students and other users of the research infrastructure.

Using state-of-the-art research infrastructure provides trainees with in-demand skills and expertise.

- Laboratories complete with a wide range of CFI-funded research equipment, provide students and post-docs with hands-on experiences that complement classroom learning.
- CFI-funded research infrastructure allows young scholars to pursue their research ideas and gain experience and confidence in operating cutting-edge technical equipment.

CFI-funded research infrastructure gives trainees a competitive advantage for their careers.

- Many trainees believe they are gaining, or have gained, a competitive advantage to pursue further studies or enter the job market as a result of their experiences with CFI-funded research infrastructure.
- Although some anticipated career-related challenges, they tend to have an optimistic outlook for the future.

Research infrastructure helps attract students and postdoctoral fellows

Introduction

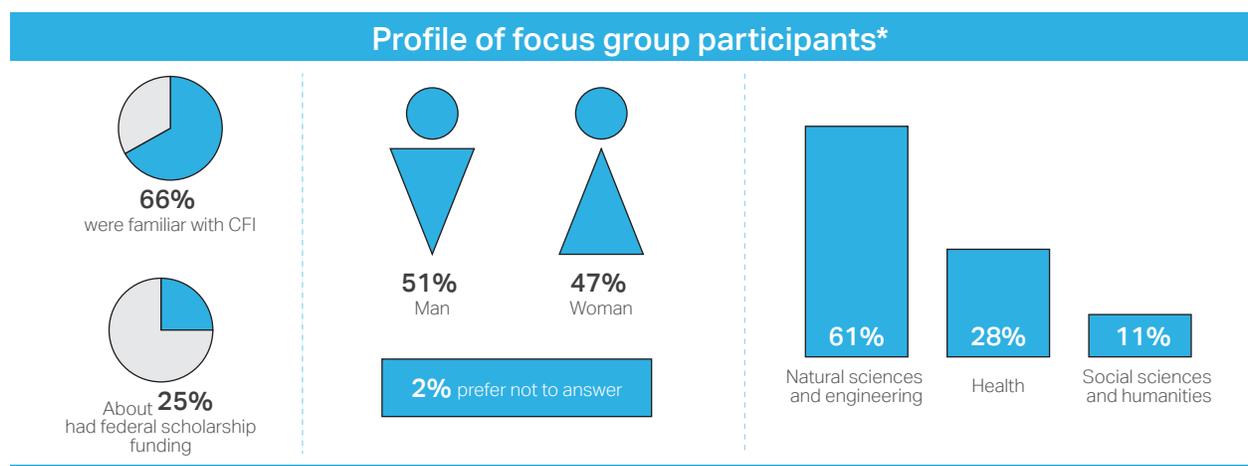
The CFI awards funding for research infrastructure through an independent, rigorous merit-review process to Canada's universities, colleges, research hospitals and non-profit research organizations to increase their ability to carry out high-quality research. The CFI receives its funding from the Government of Canada and is expected to achieve certain results through its investments, two of which are: (i) to enhance the capacity of the institutions it funds to train the next generation of researchers and (ii) to help them acquire relevant skills and expertise.

The CFI collects data from its funded institutions through project progress reports. To complement this data, and to gain insight directly from trainees who use CFI-funded infrastructure, the CFI conducted seven focus groups with participants from 11 institutions across the country in 2017. These were used to solicit opinions and experiences from current undergraduate, Master's and PhD students as well as postdoctoral fellows, each with experience using CFI-funded research infrastructure. CFI staff facilitated an in-person discussion in English or French with the aid of a semi-structured discussion guide. A total of 79 individuals participated, with nine to 16 trainees in each session. Efforts were made to ensure broad and inclusive participation across disciplines and areas of research within Canada.

Focus group participants at all institutions reported that they considered many factors when deciding where to pursue their studies. Among the factors they considered, the availability of the CFI-funded infrastructure played a significant role. For example, one participant noted that for their field of study — genomics — it was essential to have access to cutting-edge research infrastructure, so the availability of CFI-funded genomic sequencing equipment played a major role in their decision to study at that institution.

Another explained that having easy access to the research infrastructure is also an important consideration. "You don't want to be in a situation where you need to book a piece of equipment two weeks in advance and you only have 15 minutes to get your work done."

Several of the trainees who indicated that CFI research infrastructure factored into their decision to join their institution or lab were residing outside Canada — for example, Germany, the United Kingdom, Denmark, Columbia, Iran, China and the United States — at the time they made their decision. One focus group participant suggested that the availability of the research infrastructure increases the attractiveness of their lab to other students, including those from abroad, and that the research infrastructure provides visiting students with an opportunity to conduct interesting work.



* Demographic information about trainees was also obtained through an online survey sent to trainees after the focus group discussions had concluded.

Focus group participants by institution

	Postdoc	PhD	Master's	Undergrad	Others**	TOTAL
University of Ottawa	2	4	2	2		10
University of Calgary	2	5	1	2		10
University of Toronto		8	1			9
University of British Columbia	6	2		1	2	11
Simon Fraser University	3	3	2		2	10
Université de Montréal	1	6	1			8
École Polytechnique de Montréal	1	2				3
HEC Montréal			2			2
Université du Québec à Trois-Rivières	2	5	2	1	2	12
Cégep de Trois-Rivières			1	1		2
Collège Shawinigan		2				2
Total	17	37	12	7	6	79

** Although not the primary target for the focus groups, some institutions included a small number of past students employed at the time of discussion as research associates, technicians or junior faculty.

Of the few individuals who indicated their decision wasn't influenced by the availability of CFI-funded research infrastructure, a couple noted that funding wasn't yet in place to have played a role.

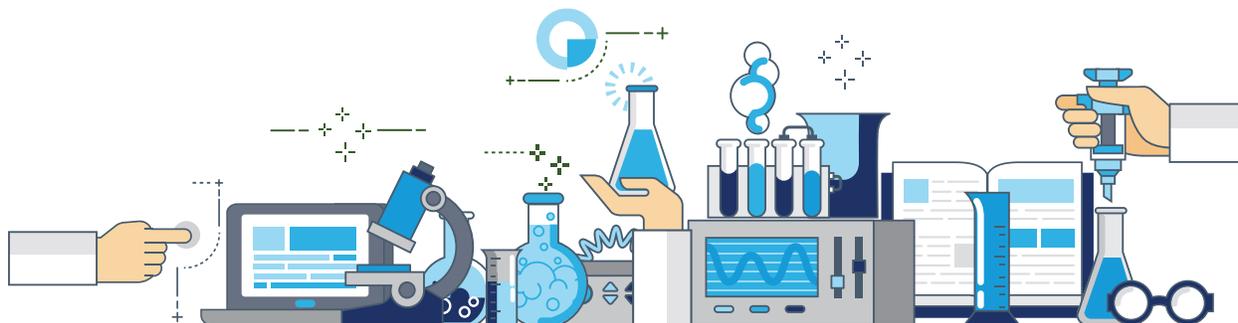
Direct access to research infrastructure matters

Participants at all levels reported having the opportunity to use a range of research infrastructure, from mass spectrometers, electron microscopes and computer hardware to surgical simulators and material fatigue testers. Most were aware at the time of the focus group that the CFI had funded some or all of the facilities and equipment they were using.

Most young scholars indicated that they used other research infrastructure in addition to CFI-funded equipment and facilities and that they discovered it was available to them through talking with other people or through departmental or laboratory websites. Several who said they only used CFI-funded research infrastructure do so because their work is self-contained within the facility in which they operate: "The lab is where I do my research and the data has to stay in there."

Most participants indicated that they use CFI-funded research infrastructure frequently and routinely as part of their program. One participant said "My lab [uses the research infrastructure] to run neuroimaging studies every day." Another reported "We use our infrastructure — microscope, PCR [polymerase chain reaction] machine, incubators for cell cultures — every day."

Participants commented on the value that hands-on access to specialized equipment adds to their training program. They believe that experiential learning gained through the use of research infrastructure provides a strong complement to theory learned in the classroom. One participant reported "The equipment in our lab lets students practice everything they are studying in their undergrad and Master's degrees." Another said "I got hired for an internship to work on a project funded by CFI and it has given me a platform to learn in a way that's more intuitive to how my brain works, compared to how I was learning when taking courses. We get to have this experience with something outside of what we would have been learning in the classroom."



Sample of equipment used by trainees

- Electron microscope
- Imaging equipment
- Spectrometer
- Media equipment
- Ultra low temperature freezer
- Laser
- Surgical simulator
- Parafusion system
- Solar simulator
- Traction/injection machines
- Thermal cycler
- Computer server

Research infrastructure creates opportunities for collaboration

The most common benefit reported by trainees as a result of hands-on experience using CFI-funded research infrastructure was the opportunity to interact and collaborate with diverse groups. These include researchers in other departments within the institution and at other universities, along with private companies, other students and other users of the research infrastructure. One trainee described their participation in a collaboration with NASA that was facilitated as a result of CFI-funded research infrastructure: “I was involved in research that used CFI-funded equipment to study northern lights and space. NASA was conducting a major mission that involved monitoring five space crafts in orbit and they needed ground infrastructure to help. Due to the [CFI-funded] remote instrumentation we had, NASA approached our lab and I became involved in that project.”

As well, trainees mentioned the importance of CFI funding in creating or renovating research space which directly facilitates collaborations. One trainee said “For some of the studies we’ve recently been involved in, we had three different labs — cardiovascular, pain and motion capture — collaborating with us. Those kinds of collaborations require lots of computers and space and if we didn’t have the huge area that we have, we’d likely not be collaborating with multiple

different labs.” Another participant explained that their research team used CFI funding to create new space which had a positive impact on the research environment as researchers and students became consolidated. This created new collaborations and enhanced existing ones. The participant further noted that this newly created space includes a work area for trainees that is “more welcoming” and encourages trainees to work collaboratively rather than in isolation. As a result, students and post-docs can discuss their challenges, brainstorm and problem solve with their peers and mentors, which was recognized as a real strength and an enhancement to their training environment.

In addition to peer and researcher collaborations, some participants across the focus groups reported having collaborated with industry as a result of the CFI-funded equipment. One noted that industry representatives visit their lab to use the CFI-funded research infrastructure and that this creates opportunities to network and meet people working in the same field in the private sector. This exposure helps trainees understand the needs of the private sector and better grasp how academic/private-sector collaborations function: “My research team evaluates devices; there are several projects underway with the private sector. They sometimes meet in our space. I think it definitely has facilitated different collaborations, including with the private sector.”

Advanced infrastructure allows a new generation to push boundaries

Many participants noted how CFI-funded research infrastructure allows them to pursue their research of interest: “I use a microscope that has been fully funded by CFI. I use it for simple screening of animals, through to live imaging of insulin secreting cells, which I wouldn’t be able to do with any other microscope.” The research infrastructure also allows them to engage in advanced research projects: “We can propose extremely complex research ideas and actually do them given the computing power we have access to.”

Many participants also reported that the research infrastructure helps improve the efficiency of the research they are conducting: “We’re looking at screening hundreds of thousands of compounds in a matter of days and the only way to do that is with automated, advanced, mechatronic-type equipment. The person hours involved in that kind of work would be infeasible without that sort of infrastructure.” Another trainee noted “We use mass spectrometry instruments and have two in the lab which are necessary to conduct our work. They also allow us to collaborate with other laboratories. Sharing these instruments increases the efficiency of the lab and allows us to carry out different projects at the same time.”

Acquiring and reinforcing skills and expertise through state-of-the-art research infrastructure

Hands-on opportunities and collaborations that take place as a result of CFI-funded research infrastructure provide a wide range of skills and knowledge. The most frequently reported was expertise developed in the operation of highly specialized equipment. By calibrating equipment and setting up and running experiments, students and post-docs gain expertise in operating and troubleshooting cutting-edge research infrastructure: “I spend a lot of time training graduate students and I recognize that over the course of my training, I’ve used enough different instruments that it has radically improved my ability to walk up to a new instrument and figure out how it works and get something accomplished with it.”

As well, participants reported advancing their research and analytical skills using CFI-funded research infrastructure. Opportunities to plan and execute complex projects help them develop their understanding of various research methodologies while allowing them to improve analytical and problem solving skills: “Everything that I’ve learned to do in my PhD — problem solving, method design and development of research questions — was brought about by CFI.”

Gaining a competitive advantage to pursue the career they want

Having hands-on opportunities with CFI-funded research infrastructure leads to the acquisition of skills and expertise and provides benefits and opportunities in terms of research and collaboration. As a result, many participants believe they possess a competitive advantage in terms of pursuing further education or future employment. For example, a handful of participants believe their experiences using research infrastructure will be beneficial for work in the private sector: “It’s nice to have access to this broad range of equipment, because it broadens the scope of the types of questions that you can then go and answer and study when you move on to a career in industry.”

A number of participants also noted that collaborations with the private sector provide opportunities to view research through a business perspective, to apply research findings beyond an academic setting and to identify potential future employment opportunities. Several focus group participants noted that private-sector collaborations related to the research infrastructure lead to employment: “[CFI-funded research infrastructure] helps to train students in a real work environment. The students do real work and find a job after graduation. And 20 percent of those who find a job are working with the same industrial partner they were collaborating with in our lab.”

As well, one participant interested in a career in academia noted that their experiences with research infrastructure positioned them for success. Due to their experiences related to the research infrastructure, including writing a successful funding proposal, implementing a multi-million-dollar project and training highly qualified personnel, they believe they will have an advantage over competitors when applying for a faculty position.

Many participants were unsure of their future plans: "I'm not really looking at the future just yet, because I'm learning my skills now and using all these new technologies." Others noted that they wanted to progress in their education or continue doing research and/or remain with their current research team.

Several noted some challenges they expect to encounter in the future such as a lack of employment positions in desired fields, and an intense competition for jobs. Future academics were concerned about a possible lack of access to state-of-the-art research infrastructure in addition to future team turnover and lack of funding for research.

Although they noted a number of anticipated challenges, only a couple of trainees indicated being unsure whether they were prepared to meet those challenges. The majority of participants across focus groups expressed confidence that they are in a good position to face any challenges encountered in the future and that their training on CFI-funded research infrastructure provides them with an advantage: "The CFI infrastructure, and experiences that I've had working here, have absolutely prepared me for [my future]."

Others reported not anticipating any future challenges in terms of their plans and that experience with CFI-funded research infrastructure

was helpful in positioning them for future success: "I use, or have hands-on experience with, basically every single piece of equipment I've seen in a research paper. I'm definitely well prepared to do a post-doc — that's what a PhD would prepare you for most. But I think the CFI funding and the equipment definitely helped."

Conclusion

Students and postdoctoral fellows at research institutions across Canada confirmed that CFI investments in research infrastructure enrich their training environment. The availability of research infrastructure funded by the CFI plays a role in attracting many trainees to their institution and/or laboratory. A wide range of CFI-funded research infrastructure is used by participants, which provides them with real experiences that complement their classroom learning. Hands-on experiences with CFI-funded research infrastructure lead to the acquisition of skills and expertise in conducting research and using highly specialized equipment, and provide benefits and opportunities in terms of research and collaboration. As a result, many students and post-docs believe they have gained a competitive advantage in terms of pursuing further education and future employment.

