



**McGill**

**Shaping a Future of  
Innovation Fuelled by  
Fundamental Research**

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*Submitted by McGill University to the House of  
Commons Standing Committee on Finance*

*August 4, 2017*

## ***1 Overview***

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Canada's research universities are key to our nation's economic competitiveness, prosperity and quality of life. They educate the next generation of knowledge workers for rewarding careers. They create new knowledge, make new discoveries, and attract talent from around the world. They collaborate with industry and communities to improve the health and wealth of our nation. The fundamental research<sup>1</sup> taking place on campuses all across our great nation contributes to innovation, trains Canada's most highly skilled workers and entrepreneurs, and improves the lives of people in Canada and globally.

Canada's 150<sup>th</sup> anniversary is the moment to reposition the nation as a global research powerhouse. The Government of Canada has taken many important steps in this direction, most recently by re-aligning funding to establish the Canada 150 Chairs in the 2017 budget. To be a talent magnet and to retain that talent, however, Canada needs a well-calibrated research ecosystem, which includes adequate levels of investigator-driven research grants.

McGill University commends the Government of Canada for mandating the Federal Science Review and calls on the Government to implement fully the recommendations of the advisory panel's comprehensive report.

## ***2 Discovery Research: The Fuel for Innovation***

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Fundamental research expands the boundaries of knowledge and provides the basis for innovation, which, in turn, leads to important societal and technological advances. Fundamental research is at the base of applied research and innovation. This is why some refer to it as basic or foundational research. It is the foundation of knowledge and innovation in a number of strategic sectors, including advanced manufacturing, agri-food, clean technology, health/biosciences, and artificial intelligence (AI).

A decade or two ago, people viewed AI as something in the realm of science fiction, rather than a disruptive technology; today, Canada has already attracted major companies and set the stage for us to become a global AI leader. However, AI would have never emerged as a strategic sector were it not for the early work by computer scientists on so-called neuronal networks. Although this research was not considered fashionable or applicable at the time, it was nevertheless the basis of what we now know to be a major development in innovation.<sup>2</sup>

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<sup>1</sup> In this submission, we use "fundamental research" to mean independent investigator-led discovery research, sometimes called curiosity-driven research, as opposed to priority-driven research.

<sup>2</sup> Baron, C, Hébert, T, et Thomas, D., « L'innovation de demain nécessite du financement aujourd'hui » *Le Devoir*, 2 août 2017 Libre opinion

Fundamental research has led to numerous other discoveries which impact on the lives of Canadians, such as insulin, canola, and the first antiretroviral drugs for HIV. More recently, an exciting example of a Canadian research achievement made possible through basic research is the groundbreaking gene-editing tool, CRISPR/Cas9, which could open the door to treatments for diseases like cystic fibrosis and leukemia. Fundamental research also provides us with the essential knowledge to allow us to move quickly when crises arise. For example, Canadian researchers were quickly able to develop vaccines for Ebola and Zika because of the understanding of the virus stemming from curiosity-driven research.

### ***3 Balancing the Ecosystem***

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Low levels of business expenditures on R&D in Canada has led governments to allocate increased academic research funding to partnership programs, applied research and priority-driven research. While priority driven research is very important to our nation, it must, nevertheless, be based on ample fundamental research discoveries.

Investing in fundamental research moves the Canadian academic community further towards the much-needed goal of gender equity. Paradoxically, as we are approaching gender parity in academia,<sup>3</sup> researchers are getting their first grant at increasingly higher ages with exceptionally low success rates and size of grants in certain disciplines. The net result is that talented young female researchers now entering the workforce are having their careers compromised by low funding success rates. According to a recent Tricouncil brief, less than two percent of NSERC's Discovery grantees are women under 36. Among all age groups, women represented less than 20% of Discovery grantees in 2014-15.<sup>4</sup> As the expert panel noted, "We handcuff ourselves in international competitions and collaborations if our research funding ecosystem fails to capitalize on the talents and energies of large segments of our population." Re-investment in open programs is key to improving success rates for women and early-career researchers in general.

Canada was able to reverse its brain drain in the 2000s, not only because of its much- praised programs like the Canada Research Chairs (CRCs) and Canada Excellence Research Chairs (CERCs), but also because our success rates for obtaining research grants were competitive internationally. Now, our CRCs and CERCs are competing for less funding. As the chart below shows,<sup>5</sup> the proportion of Tier 2 CRCs funded through CIHR has been declining steadily for the last 10 years. More than half of these Chair holders currently do not have an operating grant to

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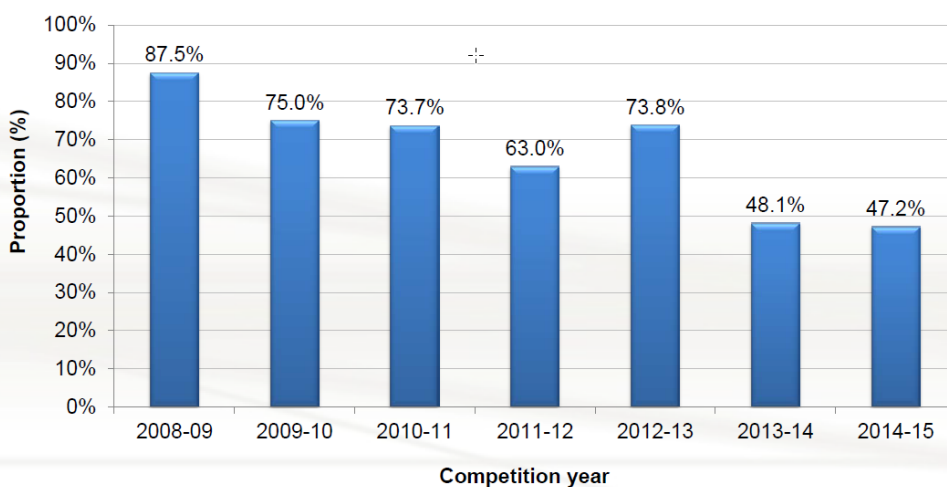
<sup>3</sup> 2017 Statistics Canada data shows that 40.2% of full-time academic teaching staff were women in 2016/2017, up from 37.6% in 2010/2011

<sup>4</sup> NSERC, CIHR, and SSHRC., *Discovery Fellowships – Launching the new Generation* (Ottawa, 2017)

<sup>5</sup> Alain Beaudet., *Presentation to the Academic Health Sciences Network Symposium* (2016)

do their research. And while the rhetoric emerging from the White House about cutting research budgets is frightening, the reality is that the U.S. Congress recently approved a \$1.1 billion increase to NIH funding, bringing its budget to US\$35.2 billion.

**Proportion of Tier II Canada Research Chair holders (health field) receiving CIHR funding as Principal Investigators\***



\* Open programs

Another key issue is in connecting fundamental research to innovation and commercialization. At the current level of investment in the Research Support Fund (RSF), Canadian universities cannot properly provide support to strengthen university- industry partnerships and encourage university-based contributions to innovation and commercialization. The creation of these complex partnerships and the transfer of knowledge into commercialization and innovation requires skilled people to work on long term engagement with the private sector, knowledge translation and technology transfer. Although these costs are eligible for reimbursement by the RSF, the low reimbursement levels prevent universities from adequately funding these activities.

Canadian innovation and commercialization performance indicators are often compared to those of the US pointing to an on-going issue on underperformance. Underinvestment in the RSF is in part responsible for this lack lustre performance. The RSF currently supports Canada’s most research intensive universities at an average rate of 19.8%, reaching a minimum of 17.6%. Quite simply, the RSF for research intensive universities is insufficient to support Canada's aspiration to be a leading nation in innovation.

The Business Higher Education Roundtable (BHER) has put strengthening research collaboration between industry and post-secondary institutions as one of its two goals. Indeed, much work has gone into identifying the conditions needed to create a dynamic and high performing environment for partnership in research and innovation. The goal, however, cannot be realized without sufficiently resourcing the infrastructure needed in the universities to build and nurture these partnerships with industry.

To ensure that Canada and Canadian researchers remain in the forefront of global science, we strongly urge the Federal Government to implement the expert panel report's recommendations. We support the organizational changes proposed in the report. However, as these changes will inevitably take considerable time to put in place, we recommend that the Federal Government proceed with re-investment on a priority basis.

#### ***4 Linking Research Training, Future Skills and Productivity***

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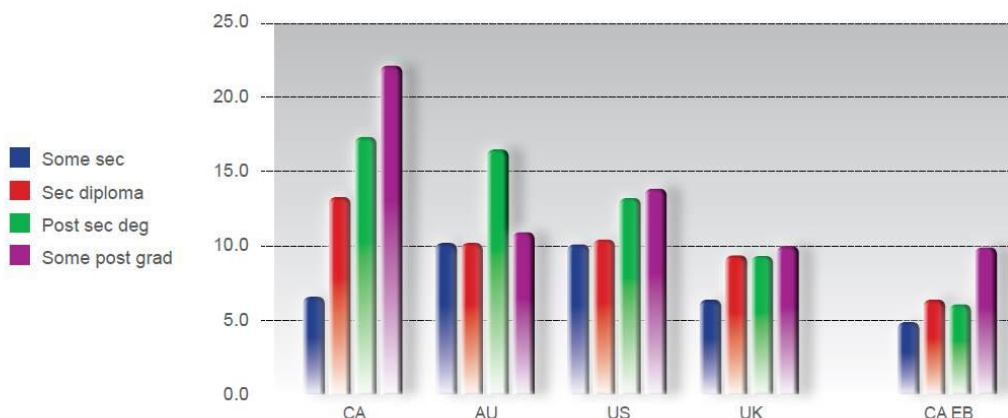
Fundamental research also plays an essential role in training Canada's most productive and skilled work force. Routinely up to fifty percent of Tri-Agency operating grants are spent on salaries and stipends for graduate students and postdoctoral fellows. This investment is over and above the fellowships and scholarships that the three federal research agencies award. In fact, a large percentage of funding from research grants goes to graduate students who learn by collaborating with their supervisors on research projects, as well as for paying the salaries for research technicians, assistants and associates and the support of undergraduate research trainees.

Productivity rises with education levels; graduate degree holders, the majority of whom have research training, are the most productive. The Institute for Competitiveness and Prosperity noted that "In Canada, those with the highest level of educational attainment are more likely to be employed, are more productive, and earn higher wages. Furthermore, educated workers are more adaptable in a changing economy, they drive innovation, and are necessary to attract high value-added industries to the region."<sup>6</sup>

The link between entrepreneurship and higher education is even more persuasive. Data from the Global Entrepreneurship Monitor shown in the chart below clearly demonstrates that entrepreneurial activity rises with increases in educational attainment generally. However, the correlation between entrepreneurial activity and level of education is far stronger in Canada than in comparator countries: the entrepreneurship rate of graduate-degree holders here is more than three times the rate of those without a high-school education. Holders of graduate degrees in Canada are considerably more entrepreneurial than in our peer countries, and investment in research can help to leverage this competitive advantage.

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<sup>6</sup> Institute for Competitiveness and Prosperity., *Looking Beyond GDP: Measuring Prosperity in Ontario*, (Toronto, 2016)



The chart above shows the percentage of the population at each education level reporting entrepreneurial activity. It compares data for Canada, the US, Australia, and the UK.<sup>7</sup> The column on the right shows the educational attainments of owner/managers of Canadian established businesses as a reference point.

## 5 International mobility

Student mobility is a two-way street – countries send their students abroad to gain global perspectives and actively recruit international students to their universities. Mobility also leads to broad economic and social benefits for Canada in the longer term.

In a globalized economy, study abroad benefits the workplace. A 2014 European Commission report found that students who studied abroad are half as likely to experience long-term unemployment compared with those who have not. Yet Canada has a relatively low proportion of university students who have had international experiences: only 2.3% in 2014-15.<sup>8</sup> Financial barriers are the largest obstacles to study abroad, particularly for middle-class and lower-income students. Many jurisdictions, such as the European Union through its Erasmus+ program, provide significant financial support to students who wish to study abroad.<sup>9</sup> Canadian students should also be able to count on this kind of support.

Canada’s research universities draw international students from around the world. These students are ideal immigrants. They have been educated in our universities, are familiar with our values, and can move into employment quickly. They add a valuable global perspective to our academic environment and have a substantial economic impact: an estimated \$5.86 billion in Canada in

<sup>7</sup> Langford, C et al., *2016 GEM Canada National Report* (Global Entrepreneurship Research Association, London, 2016)

<sup>8</sup> Canadian Bureau of International Education (CBIE), *A World of Learning: Canada’s Performance and Potential in International Education* (Ottawa, 2016)

<sup>9</sup> Two-thirds of Erasmus’s 14.7 billion Euro budget is devoted to study abroad.

2014.<sup>10</sup> International students, many of whom want to stay in Canada, provide an exceptional opportunity to revitalize our aging workforce.

## **6 Recommendations**

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- Fully implement the recommendations of the Advisory Panel on Federal Support for Fundamental Science, with immediate enactment of the following key recommendations:
  - Begin a four-year phased-in investment of \$485 M in investigator-led direct project funding;
  - Begin a gradual increase in funding to the Research Support Fund until the reimbursement rate is 40 percent for all institutions with more than \$7 M per year of eligible funding, while maintaining current thresholds to enable additional support for smaller institutions.
  - Provide CFI a stable and predictable annual budget scaled at minimum to its recent annual capital commitment and revise CFI governance to enable annualized funding;
  - Target funds to several areas of growing need within Canada’s research ecosystem: international collaboration, interdisciplinary research, high-risk, high reward ventures, crisis-oriented rapid response research projects, and indigenous research;
- Create a program along the lines of Erasmus+ to enhance the international mobility of Canadian students.

## **7 Conclusion**

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Our nation’s long history of discovery and education is part of our Canadian identity. Canada is fortunate in that its citizens understand the long-term benefits of fundamental research and attracting top talent. In a 2015 nationwide survey of Canadians’ views of universities, carried out by Abacus Data, 85% of Canadians surveyed said that governments should invest in basic research, even if it does not lead to immediate economic benefits. In a related Abacus Data survey, 87% of respondents said that Canada should work hard to attract top researchers to our country. This proportion is even larger than the percentage who thought we should try to attract foreign investors.

Strengthening Canada’s research ecosystem and research universities is a winning proposition for all Canadians. The time to act is now.

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<sup>10</sup> Roslyn Kunin & Associates, Inc. *Economic Impact of International Education in Canada – 2016 Update* (Global Affairs Canada - Roslyn Kunin & Associates, Inc., 2016)