Canadian Association of Physicists
Association canadienne des physiciens et physiciennes

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A Submission from the Canadian Association of Physicists to Canada's Innovation Agenda

Executive Summary

The Government of Canada and its Innovation Leaders have asked Canadians to provide comments about what will help make our country a global innovation leader. The Canadian Association of Physicists, as the voice of physics in our country, recommends the following measures.

On the topic of Entrepreneurial and Creative Society:
How can Canada become the best country in attracting and developing talent? How do we work together to equip youth with the right skills for the future economy?

> **Recommendation:** Keep the NSERC Discovery model strong to attract and develop the best researchers to science and technology. The three parts of the NSERC Discovery envelope (merit-based Fellowships and Scholarships, Discovery Grants with high success rates, and RTI grants with required matching funds) each fill unique roles in the Canadian fundamental science ecosystem. This overall model of "unfettered funds" works well for training flexible and innovative thinkers, and should continue, at a much higher funding rate.

On the topic of Global Science Excellence:
How can we increase demand for science, technology, engineering and math graduates?

> **Recommendation:** In order to encourage industry to hire STEM graduates, we need to increase awareness of the value of STEM education in non-academic positions. A robust and reliable system for tracking STEM graduates along their career paths would offer insights into how STEM training opens doors across a diverse range of career opportunities. Increasing science and technology outreach funding and efforts, especially to children and parents, would help to ensure our youth are exposed to the value of STEM training and would be encouraged to pursue STEM training.

How do we make best use of our science and research strengths?

> **Recommendation:** Allow for multiple and broad-based funding avenues to support diverse activities, especially when it comes to international collaborations. One size does not fit all.

We look forward to working with the federal government and its Innovation Leaders to help revitalize and invigorate Canadian science and technology in a global playing field.

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Background:

A June 14, 2016 press release outlined the plan of action for the Government of Canada's development of an innovation agenda. We welcome the opportunity to contribute to this initiative.

The Canadian Association of Physicists (CAP), with 1700 members, is Canada's national association for physicists working in industry, academia and government. The CAP strives to unleash the full potential of physics and physicists for the benefit of Canada. The CAP is recognized and respected for its science and technology expertise, and has testified at House of Commons Committees, including the Standing Committee on Industry, Science and Technology for a study on the "State of Disruptive Technologies" on June 9, 2015.

The CAP's recommendations to the Innovation Agenda identify means of support for research that will attract and retain Canada's best talent and will have positive impacts in Canada. These are consistent with the recommendations we will be submitting to the federal government's Fundamental Science Review. Our recommendations aim to develop the strong base that is essential for building a resilient and innovative workforce that will help drive Canada's entrepreneurs, businesses, and international collaborations.

One of the most important elements of Canada's innovation landscape is the transfer of knowledge and skills from academic research environments to the private and government sectors via the flow of highly qualified people (HQP) into non-academic careers. A sense of the impact of HQP on the economy can be seen in a recent Stats Can report[1] that found that almost half of the 2015 doctoral graduates trained in computer, mathematics and physical sciences were employed in non-academic careers. Similar trends were found in a study by the American Institute of Physics of doctoral graduates in physics in 2009 and 2010. These results reflect the value that the quantitative and analytical skills gained through scientific training can bring to activities well outside a student's academic discipline.

HQP impact the economy by stimulating and creating employment for others through innovations that create new spin-off companies or increase competitiveness, as confirmed by the OECD: "An economy's ability to encourage research affects its capacity to create new knowledge and stimulate innovation. Increasing specialization and rapid growth in scientific production have made research professionals with advanced research degrees the cornerstone of modern science and innovation systems worldwide."[2] Yet Canada, with 8.2 doctorate holders per thousand population, trails countries like

[1] Statistics Canada. *Expectations and Labour Market Outcomes of Doctoral Graduates from Canadian Universities.* www.statcan.gc.ca/pub/81-595-m/81-595-m2011089-eng.pdf

[2] The Organization of Economic Co-operation and Development (OECD) Science, Technology, and Industry Scoreboard 2013. dx.doi.org/10.1787/sti_scoreboard-2013-en.

Switzerland (25), Germany (14), the United States (13.5), Great Britain (12.4), and Israel (9.7).[3]

In Canada, NSERC programs support the training of a large proportion of HQP in science.[4] NSERC Postgraduate Scholarships and Postdoctoral Fellowships are the cornerstone programs that attract our brightest young people into a research career. However, the number of awards from these NSERC programs are dropping, rather than keeping pace with the growth of industrial and academic needs for these HQP. For example, comparing 2010 and 2014, there was a drop from 2520 to 1510 post-graduate awards offered and a decline from 286 to 130 post-doctoral awards offered. The number of post-doctoral awards is slipping far below Canada's HQP needs: in academia alone, approximately 400 full-time university professors were appointed in engineering, math, and science in 2010-2011.[5]

Direct support for HQP in the form of long term merit-based scholarships and fellowships that will attract the brightest students and support students throughout the duration of their program of studies must be must be given a high priority in order that we close the gap in training HQP between ourselves and our OECD competitors. These HQP will be Canada's scientific and engineering leaders in the future, and increasing the number of merit-based awards above 2010 levels will help keep a sufficient number of the best and brightest Canadian trainees in Canada.

One of the most important determinants of knowledge transfer from universities to businesses is the quality and breadth of the research that is pursued in academic settings where highly qualified people are trained before entering the private sector. While market-driven research can address specific issues for industries in the shorter term, it is the fundamental research, characterized by longer timelines and unexpected discoveries, that can generate and incubate unexpected technologies that will become transformative solutions to today's problems and incubate whole new industries of the future.

The core federal program that enables Canada's leadership in fundamental research is NSERC's Discovery Grants program. The 2016 Federal Budget provided an increase of $30 million to NSERC, which it is using mainly for the Discovery Grants program. The CAP strongly supports this initiative because it is a good start toward mitigating the ongoing erosion of this program's capacity to meet the demands of the increasing numbers of excellent researchers that are supported by it.

[3] *OECD/UNESCO Institute for Statistics/Eurostat data collection on Careers of Doctorate Holders 2010*. Cited by reference in footnote 2.

[4] The training of HQP in science is supported by programs that fund trainees directly (the NSERC Undergraduate Student Research Award [USRA] program, a number of postgraduate scholarship [NSERC PGS, Alexander Graham Bell Canada Graduate Scholarships, Vanier Canada Graduate Scholarships] programs and postdoctoral fellowship [NSERC Postdoctoral and Banting Postdoctoral] programs), and programs in which there is a training component (the NSERC Discovery Grant Program and the NSERC CREATE Program, and MiTACS).

[5] 2012-2013 Canadian Association of University Teacher's Almanac.