Written Submission for Pre-Budget Consultations

in Advance of the 2024 Budget

By:

Canadian Association of Physicists

Association canadienne des physiciens et physiciennes

Endorsed by:

Canadian Light Source | Centre canadien de rayonnement synchrotron

PERIMETER INSTITUTE FOR THEORETICAL PHYSICS

SNOLAB

TRIUMF

COMP Canadian Organization of Medical Physicists | OCPM Organisation canadienne des physiciens médicaux

Biophysical Society | Société de Biophysique du Canada

Recommendation #1: That the government significantly increase investment in the Tri-Council agencies by increasing funding to the councils' total base budgets for their core grant programming by at least 10% annually for five years to allow them to increase support for trainees.

Recommendation #2: That the government increase funding for graduate student scholarships and postdoctoral fellowships to address inflation, cost of living increases, and population growth, and to help keep our HQP in Canada

Recommendation #3: That the government implement a more strategic approach to management of major research facilities (MRFs), taking a lifecycle approach to funding to improve effectiveness in recognition of their role as national assets that support Canada's scientific enterprise.

About Us

Incorporated in 1945 and currently representing 1,700 members, the Canadian Association of Physicists/Association canadienne des physiciens et physiciennes is a broadly-based national network of physicists working in educational, industrial, and research settings from coast to coast.

We celebrate the achievements of Canadian physicists, we sponsor events and activities promoting Canadian physics and physicists, and we pursue scientific, educational, public policy and communication initiatives that enhance the vitality of physics and physicists in Canada.

Contextual Information

We have chosen to focus on recommendations that will help address problems that are reaching critical levels in recruitment, training and retention of highly qualified personnel (HQP). These personnel are critical to Canada's industrial and innovation strategies. The Government of Canada places an appropriately high value on training of HQP, recognizing that these talented individuals are drivers of innovation and, as such, are essential for the Canadian economy of tomorrow. For example, physics HQP are critical for many sectors of the economy including new quantum technologies, data science, medical technologies, energy and renewables, defense technologies, and more, all of which are essential for Canada.

Our recommendations support the critical conditions for success required of Canada's support for its research and innovation ecosystem that are necessary to make us competitive on the global stage. These conditions are outlined in the *Report of the Advisory Panel of the Federal Research Support System*:[1]

- supporting and retaining Canada's top research talent, and
- building a research enterprise that fosters discovery of new knowledge.

These steps are crucial for Canada to compete for talent and to develop the ideas needed as we face tough challenges such as climate change, health emergencies, and cybersecurity. Our recommendations support Recommendations 5, 6 and 9 from the recent *Report of the Advisory Panel of the Federal Research Support System*[1], which in turn is supported by *Successes, Challenges and Opportunities for Science in Canada*[2] (Recommendations 2, 5, 7, and 8), *Top Talent, Research and Innovation*[3] (Recommendations 3, 4, and 5), and *Investing in Canada's Future – Strengthening the Foundations of Canadian Research*[4] (Recommendation 6.1).

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1 *Report of the Advisory Panel of the Federal Research Support System,* 2023, https://ised-isde.canada.ca/site/panel-federal-research-support/en/report-advisory-panel-federal-research-support-system

2 *Successes, Challenges and Opportunities for Science in Canada,* The Standing Committee on Science and Research, June 2022, https://www.ourcommons.ca/DocumentViewer/en/44-1/SRSR/report-1/

3 *Top Talent, Research and Innovation*, The Standing Committee on Science and Research, October 2022, https://www.ourcommons.ca/DocumentViewer/en/44-1/SRSR/report-2/

4 *Investing in Canada's Future – Strengthening the Foundations of Canadian Research*, The Advisory Panel for the Review of Federal Support for Fundamental Science, 2017, https://ised-isde.canada.ca/site/canada-fundamental-science-review/sites/default/files/attachments/2022/ScienceReview_April2017.pdf

It is clear that Canada is falling behind. We invest only **1.55%** of our GDP in research and development, well below the average rate of **2.7%** achieved in the OECD[5]. Our R&D intensity has actually decreased over the past 20 years, while the OECD average has increased. The UK has set a target to reach 2.4% of its GDP by 2027, with the goal of increasing to 3% over the longer term. The EU first set a 3% target in 2002. What is Canada's target?

> "Given the **staggering investments** we see in other countries and the **stagnating investment levels** we see in Canada, a top priority must be increasing funding for research and talent."[1]

Instead of attracting more talent, we hear from our graduate programs that graduate student applications and acceptance rates are decreasing. This is detrimental because steady access to skilled talent is necessary to support an innovative economy. We find a key reason for decreased application and acceptance rates is current funding levels.

Our students are struggling with high inflation and high costs of living. To make ends meet, they are taking part time jobs, which distracts them from their research where they are working to push the boundaries of their discipline. As summarized by Ms. Sarah Laframboise, Executive Director of Support Our Science,

> *"These students are young adults, typically between the ages of 20 and 30, who care about things like housing, savings and starting a family. Currently, an average student in Canada makes $19,000 at the master's level and $21,000 at the Ph.D. level. After paying tuition and compulsory fees, this leaves a master's student with about $10,000 and a Ph.D. student with only $12,000 to live off of for the rest of the year. This is hardly enough to pay rent in most major cities in Canada, let alone other necessities like food, transportation or hydro."*[6]

The following are comments from our own students, collected at an Open Forum held at our 2023 Annual Congress:

> *"My rent is $1000, and I receive $1200 monthly. So, I have to work part-time on the side to afford food."*
>
> *"There is no inflation for the NSERC grants. The grants are not being adjusted even when inflation increases. There were more total scholarship funds when my prof was a graduate student. It is a systemic problem, especially for international students."*
>
> *"Living in a major city makes it impossible for students to survive. People just do not understand how housing crises affect us. We have to live 5-6 students together to be able to afford the rent. These living conditions are not healthy."*

In addition to making sure our students can pay their bills, higher support is required so that we can recruit our undergraduates into graduate programs and ensure that we don't lose students to other countries. While Canada ranks highest amongst G7 countries in percentage of the

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5 OECD Data, Gross Domestic Spending on R&D, 2022 or latest available, https://data.oecd.org/chart/79d3

6 S. J. Laframboise, https://www.ourcommons.ca/DocumentViewer/en/44-1/SRSR/meeting-11/evidence

population that has achieved tertiary education, it is last in percentage who have earned an advanced degree,[7] and ranks 28th in the OECD in graduate degree attainment.[8] These HQP are required to drive innovation across all areas of the Canadian economy.

To increase support for students so that we can attract and retain the best talent, two things are needed: an increase in funding for research grants and an increase in the number and value of student scholarships.

Not only is funding for investigator-initiated research stagnant, it is actually losing ground when inflation and population growth is taken into account. Researchers do not have sufficient funds to increase student support by amounts sufficient to cover inflation and cost of living increases.

Our first recommendation supports an increase in funding for investigator-initiated research. This funding is crucial because 80% of graduate student support comes from research grants.[9] These increases will allow researchers to increase support for trainees, graduate students, and post docs.

Recommendation #1: That the government significantly increase investment in the Tri-Council agencies by increasing funding to the councils' total base budgets for their core grant programming by at least 10% annually for five years to allow them to increase support for trainees.

The estimated cost of fulfilling this recommendation is $2.4B over five years.[10] The core grant programming of the Tri-Council agencies is basically the only source of funds for investigator-initiated, rather than mission-driven, research in Canada. Funding of investigator-initiated research allows scientists to explore new ideas and leads to new breakthroughs. There are many examples of investigator-initiated physics discoveries resulting in innovative technologies, economic impacts and impacts on individuals.[11] For example, Canadian Nobel Laureate Donna Strickland, while a postdoctoral fellow, discovered chirped pulse amplification, which resulted in short pulse lasers used in applications ranging from improved eye surgeries to manufacturing of glass for cell phone screens.[12] It is often difficult to predict where early-stage research will lead and thus it is important to support a broad network of researchers to keep the pipeline of new ideas and innovation flowing.

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7 Educational attainment, at least Master's or equivalent, The World Bank, https://data.worldbank.org/indicator/SE.TER.CUAT.MS.MA.ZS

8 Dr. Gail Murphy; https://www.ourcommons.ca/DocumentViewer/en/44-1/SRSR/meeting-7/evidence

9 S. J. Laframboise et al., *Analysis of Financial challenges Faced by Graduate Students in Canada*, Biochem. Cell Biol. 00: 1-35 (2023) | dx.doi.org/10.1139/bcb-2023-0021.

10 Data provided by Support Our Science, www.supportourscience.ca

11 P.S. Vincett, *Economic impacts of academic research: Canadian physics pays off!*, Physics in Canada, **61,** 351 (2005).

12 For a further sampling of Canadian discoveries, inventions and achievements see Exhibit 2.1 in Ref. 4.

The second pillar is government scholarships for graduate students and postdoctoral fellows. These need to be adjusted for inflation and increasing population. Over the past 20 years, fellowships were adjusted once; scholarships have been stagnant.

> *"Funding amounts for graduate student scholarships, for example, have not changed in nearly two decades, which, in inflation-adjusted terms, means a 35% decline…. As we seek to improve access to opportunity and support diversity, increases in the number and the value of these awards are critical."*[13]

Recommendation #2: That the government increase funding for graduate student scholarships and postdoctoral fellowships to address inflation, cost of living increases, and population growth, and to keep our HQP in Canada.

Estimates show that this requires increasing the value and number of scholarships to graduate students by 50% and increasing the value of postdoctoral fellowships by 50% and their number by 100%. The estimated cost of fulfilling this recommendation is $184M over 5 years.[14]

Due to the competitive nature of HQP recruitment, the amounts awarded through scholarships will impact the level paid through research grants and will increase compensation for all students.

Increased funding should be accompanied by modernizing and harmonizing the existing funding programs to simplify delivery of the current range of scholarship and fellowship programs, currently administered at both the granting council and the tri-agency level.[1]

The third pillar required to support our goal of research and innovation excellence is research infrastructure, as the success of our students depends in part on the quality of the tools they have to work with. We support the recommendations made by *The Advisory Panel on the Federal Research Support System* and others that the government manage its investments in major research facilities (MRFs) strategically, taking a lifecycle approach to funding to improve the effectiveness of these investments. These facilities should be treated as national infrastructure, not projects.

Recommendation #3: That the government implement a more strategic approach to MRFs, taking a lifecycle approach to funding to improve effectiveness in recognition of their role as national assets that support Canada's scientific enterprise.

Infrastructure investments will help make Canada more competitive in attracting HQP, providing them with the state-of-the-art technologies required to push science forward.

Implementation of these three recommendations will provide the pillars of support needed to ensure a successful and competitive research environment and, in turn, an innovative and productive economy. Fundamentally, investing in our intellectual and research infrastructure means training our best and brightest so that their work will result in the cutting edge technologies required to solve some of the world's most critical challenges. These HQP, who

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13 Dr. Gail Murphy; https://www.ourcommons.ca/DocumentViewer/en/44-1/SRSR/meeting-7/evidence

14 https://www.supportourscience.ca/learn-more

are trained at the frontier of knowledge and driven to solve new problems, will in turn facilitate new technologies and intellectual property to support economic growth, helping Canada and Canadian businesses tackle future challenges. For two decades, successive Canadian Governments have trumpeted the high value of graduate students and postdoctoral fellows to the Canadian economy. Yet these same Governments have been unwilling to increase federal funding to support Canada's young researchers, forcing many to struggle to pay for food and housing and consider training in countries with better conditions. We hope our current Government will honour their value statements and take the steps necessary to address this situation starting in 2024.