

**Written Submission for the
Pre-Budget Consultations in
Advance of the 2020 Budget**

By: Canadian Association of Physicists

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RECOMMENDATION 1

Support for operations of fundamental research programs:

We recommend increasing the funding of NSERC Discovery grants by \$85M, phased in for the next two years to meet the target identified in Canada's Fundamental Science Review.

RECOMMENDATION 2

Support for Graduate Students, Postdoctoral Fellows:

We recommend increasing the budget for the existing suite of graduate scholarships and post-doctoral fellowships by of \$140M per year as per the recommendation of Canada's Fundamental Science Review.

RECOMMENDATION 3

Support for the Renewal of Aging Research Equipment for fundamental research:

We recommend increasing the budget for the CFI Infrastructure Operating Fund by \$30M per year, as per Canada's Fundamental Science Review, as well as providing permanent funding to meet the need for the NSERC Research Tools and Instruments grants, estimated at \$60M per year.

RECOMMENDATION 4

Establish an orderly system for stewardship of Major Research Facilities:

We recommend establishing an orderly system of coordination and oversight for Canada's nationally important research facilities, as per Canada's Fundamental Science Review.

Who We Are:

The CAP, with 1800 members, is Canada's national association for physicists working in industry, academia and government across all sub disciplines of physics. The CAP strives to foster a vibrant, inclusive and engaged Canadian physics community that benefits Canada. The CAP is recognized and respected for its science and technology expertise, and has testified at House of Commons Committees.

We look forward to working with your Committee to help tackle the challenge of climate change through judicious infusions of funding for scientific research, education and training.

Introduction:

The House of Commons Standing Committee on Finance is seeking expert consultation as it develops its economic strategy for 2020. In considering the questions asked on the topic of Climate Emergency: The Required Transition to a Low Carbon Economy, the CAP submits that both will be addressed if the Federal Government substantially increases Canada's investments in its intellectual infrastructure.

Background:

Climate change may be the largest problem that mankind faces today. It is both a societal and a technological challenge. The development of new technologies, together with the improvement of existing ones, is the key to Canada being able to increase energy efficiency and decrease emissions while maintaining a sustainable, high quality of living for Canadians. Canada's success in this area depends on balanced support of research, including discovery-driven fundamental research. In this regard, Canada has taken important steps in response to the April 2017 report of Canada's Fundamental Science Review¹. Addressing the important themes for Budget 2020 – climate change, national research, and development and innovation – requires that the path forward continues to be based on a cohesive, vibrant, sustained research ecosystem that addresses both current and future societal and environmental problems.

Canada was among over 20 countries who committed to "Mission Innovation", a multinational COP21 commitment in 2015 to double investments in clean energy research and development within five years. Mission Innovation identified fundamental research on materials as a focus area, along with ten areas of applied research across a spectrum of clean energy production, distribution and efficiency. Fundamental research produces new knowledge that underpins advances in all of the other areas of applied research. It is critical for Canada to develop the technologies that are transformative, the so-called "disruptive technologies" that will secure prosperity and safety of current and future generations of Canadians. Canada's, and even the world's, long-term success in meeting its biggest challenges depends on balanced support of research, including both applied research and discovery-driven fundamental research.

The language of "Climate Emergency" suggests the urgency of taking action now to address a serious and long-term problem and aims to counter the human tendency to lose focus on long-term solutions in favor of short-term fixes. In the same way, our submission focuses on strengthening

¹ <http://www.sciencereview.ca/eic/site/059.nsf/eng/home>

fundamental research because it is too easily forgotten in public discussions, which tend to focus on shorter-term improvements to technology at the possible expense of long-term progress.

We applaud the Government of Canada's effort to give appropriate attention to fundamental research when it initiated Canada's Fundamental Science Review, a panel that included university and funding agency administrators, industry leaders, and Canada's 2015 Nobel Laureate, physicist Art McDonald of Queen's University. The report of Canada's Fundamental Science Review, released in April 2017, documents declining support of fundamental research, defines the real needs in this area, and outlines a concrete path forward to meet that need. Over the past 15 years Canada's research funding as a percentage of GDP has declined from 2% to 1.6% while that of virtually all other major nations grew.

To date, through Budgets 2018 and 2019, the Government has acted on some of the report's recommendations. However, more can and must be done to help the research community advance Canada's global competitiveness and prosperity. Canadian researchers and students are at the forefront of important discoveries, and their expertise and ability to inform discussions about climate change, society, and the economy could be better leveraged by both the public and private sectors.

We strongly encourage the committee to fully implement the recommendations of Canada's Fundamental Science Review to increase support for research that will attract and retain Canada's best talent and have growing positive impacts in Canada. This will drive the development of the new technologies needed to fight climate change. We make this statement again this year in parallel with many other Canadian organizations, notably, the Canadian Consortium for Research (CCR), which represents professional associations covering many research disciplines.

Fundamental Research and Training of Highly Qualified People

Investing in the operations of university-based fundamental research labs provides value both in new scientific knowledge and in the training of highly qualified future workers. These highly qualified people, who are trained at the frontier of knowledge and are driven to solve new problems, will take what they have learned to find solutions for sustainable energy, transportation and economic growth, thereby helping Canada, and ultimately the world, tackle climate change. If Canada is to remain both a competitive and prosperous nation in the 21st century, it is essential that the government provide adequate support for fundamental as well as applied research.

Canada's Fundamental Science Review noted that operating grants for fundamental research labs have been largely stagnant for at least a decade, and recommended increases to open-competitions for operating grants to reach adequate levels of around \$400M per year. Budget 2018 provided increases, but about \$85M more per year is needed to reach the target.

Canada's Fundamental Science Review also noted that the value and number of graduate scholarships and post-doctoral fellowships have not kept up in the last decade in proportion to increased enrollments. Budget 2019 provided for some additional funding for graduate student research scholarships but was much less than the Review recommended to meet the need: \$140 million per year across the three granting councils.

Renewal of Research Equipment for Fundamental Research

Canada's Fundamental Science Review found that "the current level of CFI's Infrastructure Operating Fund (IOF) is insufficient to cover more than a small fraction of the ongoing costs of research infrastructure at a wide range of institutions. This leads to ineffective use of smaller-scale equipment and means that researchers sometimes spend inordinate amounts of time trying to secure funding." Additional funding of \$30M per year should be provided to the CFI with a mandate to meet the special operating needs of individual researchers with small capital awards.

Similarly, the NSERC Research Tools and Instruments (RTI) program has provided critical support for researchers to replace aging research equipment up to \$200K in value. However, this program is funded only on year-end unused funds redirected from other programs, which means that the funding available in any year is uncertain and, at a typical value of around \$25M, inadequate. Permanent, stable funding is needed to meet the demand for the NSERC Research Tools and Instruments grants, estimated at \$60M per year.

Major Research Facilities

The Fundamental Science Review recommended Canada establish an orderly system of coordination and oversight for the life cycle of federally supported Major Research Facilities (MRFs). While progress has been made to improve Canada's *ad hoc* unique approach for each MRF, no one body is responsible for the MRF portfolio. A system is needed in which there are coordinated national reviews, adequate funding for the operations of Canada's national research facilities based on a long-term, national plan. The system needs to manage the life-cycle of investments from conception, through construction and operations to decommissioning, and, if appropriate, the establishment of replacement facilities.

Progress is being made by the Government in considering such a system; in the meantime, however, some MRFs are not receiving adequate attention and still risk falling through jurisdictional cracks because no agency is responsible for them. A prime and recent example of this is the NRU reactor, which was Canada's primary facility for neutron scattering, a versatile and irreplaceable materials research method. The materials research community developed a vision (the Canadian Neutron Initiative) for a new framework for access to neutron scattering after the NRU reactor was shut down, but lack of a federal agency responsible for this area of research required scientists to lobby directly for funds as a one-off request. Despite the Finance Committee recommending that the Canadian Neutron Initiative be funded during two consecutive budget years, no funding was provided in either the 2018 or 2019 budgets. Thus, in 2018, Canadian research suffered a severe blow when the NRU reactor at Chalk River was shut down due to age without a replacement facility in place.

We urge the government to continue to push for progress on establishing an orderly framework for MRFs and, until such a framework is established, give due and timely attention to one-off requests that do not fit into existing funding programs, such as the Canadian Neutron Initiative.

RECOMMENDATIONS

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We recommend increasing the budget for the existing suite of graduate scholarships and post-doctoral fellowships by of \$140M per year as per the recommendation of Canada's Fundamental Science Review.

Support for the Renewal of Aging Research Equipment for fundamental research:

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Establish an orderly system for stewardship of Major Research Facilities:

We recommend establishing an orderly system of coordination and oversight for Canada's nationally important research facilities, as per Canada's Fundamental Science Review.

CONCLUSION

We strongly encourage the Government to fully implement the recommendations of Canada's Fundamental Science Review to increase support for research that will attract and retain Canada's best talent and have growing positive impacts in Canada. Implementation of the remaining recommendations will help Canada find answers to questions needed to keep businesses productive and competitive, to enhance the well-being of Canadians, and to fight climate change.