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February 3, 2014

TO: Science, Technology, Innovation Consultation, Industry Canada

FROM: Prof. Kenneth Ragan, President, Canadian Association of Physicists

SUBJECT: Discussion questions in *Seizing Canada's Moment. Moving Forward in Science and Technology*

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On behalf of the Canadian Association of Physicists, Canada's national organization for physicists working in industry, academia, and government, I am writing in response to the call for discussion contained within the recent science and technology consultation paper entitled *Seizing Canada's Moment, Moving Forward in Science and Technology*. Our members agree that Canada must continue to build upon the accomplishments of its Science and Technology community and welcome the opportunity to comment on the issues raised in the consultation document. Our Association's responses to the discussion questions raised in the consultation paper follow.

The first question listed for discussion under section A, *Business Innovation* is:

- **Building on the advice provided by the Expert Panel on Federal Support for Research and Development, what more can be done to improve business investment in R&D and innovation?**

In a letter<sup>1</sup> to the Prime Minister, dated March 13, 2012, the president of CAP provided comments on the 2011 report of the Expert Panel on Federal Support for Research and Development (the Report). Many of those comments are also pertinent to this discussion question and are reiterated here.

CAP agrees with the Report that the critical importance of research and innovation calls for a full Minister at the Cabinet table, not just a Minister of State. Along with other experts, CAP believes that technological innovation cannot be separated from the longer term discovery-driven research and the more targeted applied research that makes such innovation possible. **CAP supports the establishment of a full Ministry of Science, Technology & Innovation**, rather than the more limited Ministry of Innovation recommended in the Report.

**CAP also supports expansion of the very successful Industrial Research Assistance Program (IRAP) program.** CAP agrees with the Report's recommendation that the program mandate be expanded to include early-stage development, along the lines of the successful U.S. Small Business Innovation and Research (SBIR) program. This could mitigate some of the enormous challenges encountered in moving technologies to commercialization from research.

The Report proposed a commercialization vouchers pilot program, to connect small and medium enterprises (SMEs) to providers of commercialization support. CAP sees merit in this concept. In his 2012 letter to the Prime Minister, the CAP president suggested that this concept be extended to R&D alliances between companies and academia. The credit note pilot program announced in the 2013 Federal Budget appears to do that. **CAP supports**

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<sup>1</sup> <http://www.cap.ca/en/news/2012-03-31/cap-writes-prime-minister-re-nrc-and-other-matters-jenkins-report>

**the credit note concept and recommends that it be implemented on a larger scale if the pilot program proves successful.** Because of the commitment of time and resources required for a company to establish a relationship with a university, define a joint program, and write a proposal, uncertainty regarding the possible funding of such a program may deter companies from even starting the process. With a voucher or credit note in hand (based on a fairly short statement of the problem and of possible approaches), companies and their potential academic partners should be better motivated to pursue the necessary relationship-building and defining of a joint program.

The Expert Panel Report also recommended simplification of the Scientific Research and Experimental Development (SR&ED) program and a shift in emphasis toward initiatives that can encourage innovation more effectively. CAP supports that recommendation and notes work from the UK<sup>2</sup> that suggests spending on Research Councils, the UK equivalents to our tri-councils, may have much more economic impact than spending on Tax Credits, even within a few years of the spending.

The second question provided for discussion under section A, *Business Innovation* is:

- **What actions could be taken, by the government or others, to enhance the mobilization of knowledge and technology from government laboratories and universities, colleges and polytechnics to the private sector?**

The National Research Council plays an important role in both the direct and indirect transfer of knowledge and technology to the private sector. The Expert Panel on Federal Support for Research and Development recommended continuing but transforming the current NRC Institutes: some as business-facing industry-oriented non-profit research centres mandated to undertake collaborative R&D and commercialization projects with business organizations, some (those currently undertaking more basic research) as centres engaged in basic research and affiliated with one or more universities, and some as part of a non-profit organization mandated to manage what are currently NRC major science initiatives. CAP is more supportive of this model than of one which predominantly emphasizes short-term efforts aimed primarily at immediate industrial needs. As outlined in our March 2012 letter to the Prime Minister, there are numerous examples of major contributions to Canada's economy and well-being that are attributable to the research and expertise built up over many years at NRC. **CAP believes that the Report's recommendations could preserve the very valuable expertise of the NRC Institutes and allow them to continue to make major long-term contributions from which industry and all Canadians will benefit.**

Extension of a voucher system to R&D alliances between companies and academia, as described in our response to the first discussion question, would be one way to enhance the transfer of knowledge from academic to private sector environments. There are many levels on which linkages between academic research and the private sector can be effective and many different ways in which stakeholders might interact. A program environment that recognizes this range, and encourages the private sector to engage with the academic research community in areas where commercialization may occur on a longer as well as shorter timescales, would help to build those linkages.

**The most important determinant of effective academic/private sector knowledge transfer, however, is the quality and breadth of the research that is pursued in academic settings.** In particular, sustaining Canada's capacity to innovate and compete internationally is dependent on its commitment to support research across the

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<sup>2</sup> J. Haskel and G. Wallis, Centre for Economic Policy Research, Discussion Paper 7725 (March, 2010), referenced in *Nature* (editorial) 466 p. 296 (July 15, 2010).

spectrum from enabling research with long-term significance to targeted research with identifiable short-term applications. While highly targeted research can address specific issues in existing commercial enterprises, **it is fundamental research, characterized by longer timelines and unexpected discoveries, that can generate new technologies and approaches and provide transformative solutions to existing problems.**

A particularly important mechanism for the transfer of knowledge from academic research efforts to the private sector is the flow of highly qualified trainees into private sector careers. For this mechanism to be effective, the capacity of the private sector to employ highly qualified graduates is essential, not just because of its direct effect on knowledge transfer but also because the willingness of trainees to pursue career paths depends crucially on the existence of viable and meaningful career opportunities for those trainees in the private sector. **Programs should be implemented to encourage industry to expand and strengthen their R&D initiatives.**

Under section B. *Developing Innovative and Entrepreneurial People*, the discussion question is:

- **How can Canada continue to develop, attract and retain the world's top research talent at our businesses, research institutions, colleges and polytechnics, and universities?**

CAP commends MITACS's valuable contribution to the development of private sector career opportunities for highly qualified personnel in Science and Technology. We endorse the expansion and broadening of such initiatives. As noted above, a crucial factor in the success of such programs is the capacity of the private sector to provide meaningful and sustained career options for highly qualified personnel and we endorse efforts to encourage the private sector to pursue research and development having medium and long-term potential in addition to that having predominantly short-term implications.

Three critical considerations in Canada's ability to attract and retain internationally competitive research talent in academic settings are the **quality of our research infrastructure, the effectiveness of our research funding sources, and the ability to attract highly motivated potential trainees with suitable backgrounds.**

With regard to research infrastructure, the Indirect Costs Program is a critical contribution. CAP commends the government for its commitment to continued support of this program. Another aspect of research infrastructure that is key to the attraction and retention of the best research talent is the development, maintenance, and access to regional, national, and international shared facilities (such as particle accelerators, synchrotron light sources, neutron scattering facilities, materials preparation and characterization facilities, high performance computational facilities, etc.) that are competitive with the best in the world. CFI has made important contributions in this regard but **it is important that attention be paid to supporting the long-term operational requirements of such facilities and their accessibility to researchers across the country.**

Attracting and retaining internationally competitive research talent can also be dependent on the extent to which individual laboratories can be properly equipped and maintained. NSERC Research Tools and Instruments (RTI) funding has been used very effectively for timely funding of smaller scale equipment and equipment needed to pursue rapidly emerging research directions in individual laboratories. Recent reductions in funding of the RTI program, from an average of \$35M/yr in 2003 to an expected \$6-10M/yr in 2013, and changes in program priorities have made it increasingly difficult for established researchers to maintain the infrastructure that is crucial to the operation of individual laboratories. **CAP strongly recommends reversing recent changes to the funding level of this program.**

The flexibility and effectiveness of NSERC's Discovery Grant program has been a critical contributor to Canada's internationally-competitive research success and was recognized as such in the 2008 Report of the International Review Committee on the Discovery Grants Program<sup>3</sup>. Despite the emergence of other programs, **the quality and success of this key program remains the prime determinant of Canada's ability to attract and retain internationally competitive research talent.** Nevertheless, inflation has eroded the funding of this program over the past several years. In its August 2013 pre-budget submission to the House of Commons Standing Committee on Finance<sup>4</sup>, CAP recommended that baseline funding for the Discovery Grant program be increased by at least \$15M (~5%) in order to compensate for the effect of inflation and recent changes. CAP continues to support this recommendation.

Another important consideration for internationally competitive academic research talent is access to a pool of motivated and talented potential trainees with suitable academic and research skills. Continued support for direct trainee funding, through programs such as the Canada Graduate Scholarships or NSERC CREATE, is very important. The NSERC Discovery Grant program, however, remains the key vehicle for training both through direct contributions to trainee stipends and through support of the research programs in which trainees gain experience. For researchers seeking to recruit trainees to graduate programs, the quality of undergraduate training, including involvement with research at the undergraduate level, can also be an important factor in research productivity and thus in researcher retention. **The capacity to involve undergraduates in research is directly dependent on the funding provided by NSERC Discovery Grants to researchers across a broad range of areas, of geographical locations, and of sizes of both research group and institution.** This is another important way in which the Discovery Grants program contributes to the vitality of Canada's academic research community and to its ability to attract and retain top research talent.

Under section *C. Excellence in Public and Post-Secondary Research and Development*, the first discussion question is:

- **How might Canada build upon its success as a world leader in discovery-driven research?**

Many of the factors that contribute to Canada's leadership in discovery-driven research are the same ones that are important for attracting and retaining internationally competitive academic researchers and for building effective linkages with the private sector.

Canada's international competitiveness and capacity for sustained innovation depend on the continued and balanced support of research spanning the spectrum from programs with long-term objectives to more targeted projects with near-term applications. **The core element of Canada's leadership in discovery-driven research is the NSERC Discovery Grants program. Its continued effectiveness depends on being funded at a level that counters recent erosion by inflation.** CAP supports the promotion of linkages between academic, government, and the private sectors but emphasizes that long-term viability of our research competitiveness depends on demonstrating to potential trainees that meaningful career options exist in all three sectors. In particular, initiatives that encourage the private sector to develop in-house research capacities rather than becoming overly dependent on academic research to provide short-term solutions should be pursued.

The success of Canada's discovery-driven research effort is also dependent on continued renewal of the research community and its research infrastructure. As funding programs evolve, it is essential that new researchers

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<sup>3</sup> [http://www.nserc-crsng.gc.ca/\\_doc/Reports-Rapports/Consultations/DGinternational\\_review-rpt\\_e.pdf](http://www.nserc-crsng.gc.ca/_doc/Reports-Rapports/Consultations/DGinternational_review-rpt_e.pdf)

<sup>4</sup> <http://www.cap.ca/en/news/2013-08-13/cap-makes-submission-house-commons-standing-committee-finance-re-2014-federal-budget>

receive adequate support, primarily through the Discovery Grant program, not only to establish their research programs but also to sustain those programs.

Canada's ability to compete and participate in the development of innovative technologies depends on the availability and sustained accessibility of appropriate scientific infrastructure over a range of scales. One particularly critical issue at this time is to restore the capacity of NSERC's RTI program to a level where it can address timely research equipment needs not met by programs of the Canada Foundation for Innovation (CFI). Even with access to large institutional and/or shared facilities, most research originates in an individual's laboratory or facility. Equipment funding is critical to many early career researchers and prioritization is appropriate. For established researchers, however, the ability to renew essential equipment can be limited by funding criteria and any tendency to prioritize collaborative or partnership-based research in competitions for equipment can risk the promotion of artificial linkages. **CAP recommends restoration of RTI program funding to levels that would allow the resumption of open competitions with appropriate success rates for both established and early career researchers.**

The second discussion question under section *C. Excellence in Public and Post-Secondary Research and Development* is:

- Is the Government of Canada's suite of programs appropriately designed to best support research excellence?

With regard to the government sector, we recognize the need for ongoing assessment and renewal of programs. **We are, however, also concerned that overly focusing government sector research efforts on areas with direct short-term commercial implications may limit the ability of the government to anticipate rapidly emerging areas and position Canada to compete or participate in the exploitation of new developments and technologies.**

Within the private sector, an environment that enhances the potential survival of start-up companies is very important but we believe that initiatives to encourage existing commercial enterprises to pursue longer range research objectives within Canada would also help to balance our research environment and encourage more talented young people to view private sector research as a viable and attractive career option.

In the academic sector, excellence is well supported by a range of existing programs. Sustaining that excellence depends on depth in the research community and an environment that allows the development of new research efforts and new research directions. **CAP does not encourage the proliferation of new programs but rather the more effective integration of goals within the existing suite of programs.** In particular, CAP believes that enhanced support for the NSERC Discovery Grant program, which supports research and training across the spectrum from long-term to highly applied and over a broad range of institution and research group scales, will best contribute to Canada's ability to engage at the highest level in emerging and rapidly developing areas of science and technology, to compete internationally, and to train the highly qualified personnel who will lead Canada's innovation in the private sector.