

How can Canada support a solid science policy? Federal support for investigator-led science is one element of a successful formula. Our graduate schools are home and hub for many future scientists and it is in this context that CAGS shares its vision and comments.

## Supporting Investigator-Led Science

Notes and  
Recommendations from the  
Canadian Association for  
Graduate Studies

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# SUPPORTING INVESTIGATOR-LED SCIENCE

*The Canadian Association for Graduate Studies (CAGS) thanks the Panel for this opportunity to express its views and offer recommendations that might be included in advising the Minister of Science on the most significant issues associated with the current system of federal support for investigator-led science.*

## Introduction

How can Canada support a solid science? Federal support for investigator-led science is one element of a successful formula.

And since the broad science enterprise is dependent on people, effective methods of supporting established and emerging researchers as well as students is critical.

Canada's graduate schools are home and hub for many of these scientists. Over the past years CAGS members and their institutions have worked at identifying the range of knowledges, intellectual abilities, competencies and attitudes required by graduates to ensure they're prepared to apply their research knowledge and skills to advance science, technology and scholarship in and outside the academy. Working with students, partners, faculty and administrators, graduate schools are evolving and responding to the dynamics of the world around us.

But there are some things graduate programs can't change on their own.

It is essential that Canadian Institutions and funding agencies respond to a changing landscape with creativity and innovation. A realignment of the structure and purpose of federal funding programs could play an important role.

## Background

The basic components of the PhD have not changed significantly since the origin of the modern PhD, which was developed primarily as a vocational degree for the professoriate. That is why CAGS is reviewing the Canadian model of the doctoral dissertation and comprehensive/candidate exam (CE). We are exploring its relationship to learning outcomes relevant to academic and non-academic careers. We are questioning if today's student researchers are being sufficiently prepared for the modern academic environment and for advancing knowledge, technology, discovery and scholarship outside the academy.

CAGS and other stakeholders have worked to identify the range of knowledges, intellectual processes, competencies and attitudes required of new graduates, especially those working outside the academy. These attributes have not necessarily been the focus of educational efforts or assessment in core components.



*DR. MICHELLE PARKER, UNIVERSITY OF VICTORIA, CAGS DISTINGUISHED DISSERTATION WINNER 2015*

Our examination involves extensive consultation. We want to encourage a diversity of recommended innovations and models which could promote competencies relevant to academic and non-academic careers. A summary of these consultations and analyses will be presented at a national meeting and incorporated into a document for use by graduate education leaders across the country. Through this work we intend to make a significant contribution to the future of graduate education and fundamental science in all disciplines.

With this information in hand, Canadian Institutions and funding

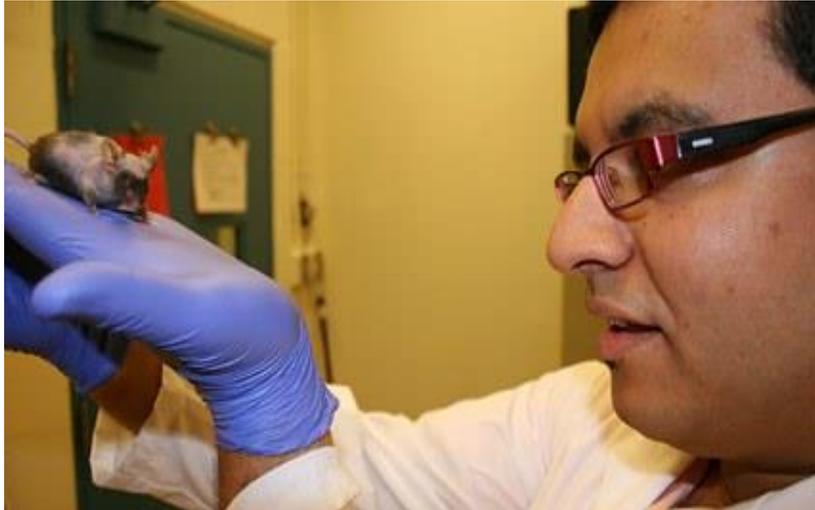
agencies will have a clearer roadmap. Canada's global competitiveness and the potential impact on the careers and lives of emerging researchers depend on our ability to act in a timely fashion.

## Money Talks

Students are essential to the research enterprise, the economy and society. They are a sound and strategic investment. Yet the current system sends a lukewarm message.

Direct funding for the support of students, scholarships, has not materially increased since 2009<sup>1</sup> in any of the granting councils, despite the significant increase in enrolment. A smaller proportion of students are now receiving scholarships. CAGS values the establishment of, for example, the the CREATE program. But, it is troubling that funding for these initiatives came from redirecting monies

allocated for postgraduate scholarships (i.e. cost neutral).



*DR. ADEEL SAFDAR, McMASTER UNIVERSITY, RECIPIENT, CAGS DISTINGUISHED DISSERTATIONS AWARD*

**CAGS recommends an increase in the funds available for scholarships across the councils - at a minimum, by the amount redirected to support the CREATE program.**

## Funding that reflects global realities

Science and research has to reach out beyond our own borders to draw in talent and to disseminate Canadian knowledge. Student mobility is of growing importance in the bid to transcend the borders of the knowledge economy, build a Canadian reputation for world-class research, and engage in resolving global problems.

The Vanier scholarship is the only award within the system that can bring in global talent. Limited opportunity to support international research trainees is contrary to the goal of producing research leaders, establishing international ties, and addressing global issues. International recognition and partnerships can be improved by a recruitment and development program that extends beyond our borders.

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<sup>1</sup> Statistics Canada data

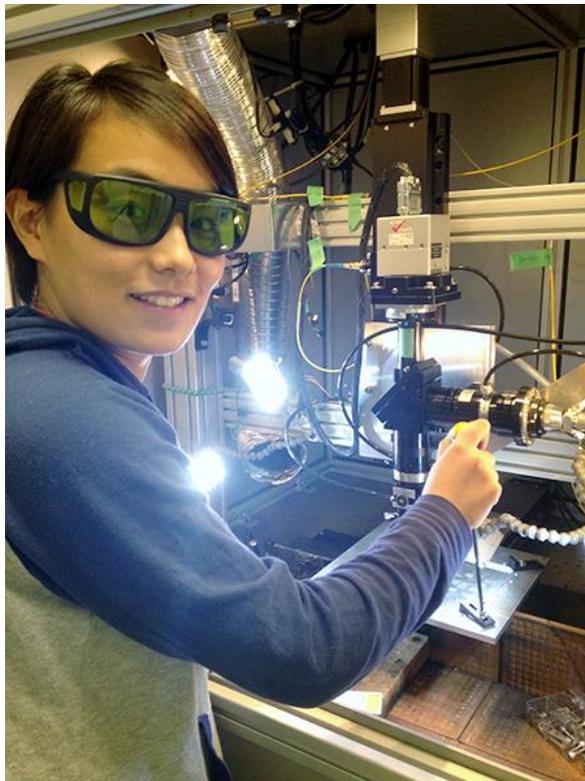
**CAGS recommends the expansion and development of pathways and funding opportunities to enhance graduate student mobility for foreign students and Canadian students who are engaged in research with foreign partners.**

**CAGS recommends the expansion of the Canadian Graduate Scholarships program – with new money – to attract top students from across the world to study in Canada. This will have the impact of further opening Canada and Canadian universities to the world.**

## Recruit and Develop

Significant issues require multi-faceted, multi-disciplinary methodologies and approaches. Creative solutions and innovations often stem from the complementarity of ideas and methods involving multidisciplinary teams. It is important to train new researchers to work in this dynamic. That is why interdisciplinary graduate programs and specializations are on the rise.

Our member universities have recognized that demands of science, scholarship and discovery rarely fit within a single discipline (or cognates).



But the current funding system is not equipped to support leading-edge research that does not align with one particular granting council or with their current program offerings. The Tri-Agencies typically recruit reviewers with world views that know social science research paradigms and/or science paradigms, but seldom both. There is a need for reviewers to be familiar with norms and methods appropriate for addressing challenges at the intersections of disciplines where innovation often happens – it's integral to discovery research.

The Tri-Agencies profess to fund leading edge, creative and innovative research yet the existing programs are too rigid to adequately accommodate truly innovative, interdisciplinary research that is proposed. There are numerous instances of applicants having to spin their proposals in order to achieve necessary rankings.

It is time to address this reality head-on.

CHENMAN YIN, QUEEN'S UNIVERSITY, CANADA'S 3MINUTE  
THESIS, PEOPLE'S CHOICE AWARD

Funding protocols should reflect and support interdisciplinary research and not constrict it to fit within the mandate of one of the three agencies. Fund the best science – not the science that fits an outdated mould.

**CAGS recommends that the Tri-Agencies address the challenge of adequately reviewing and assessing interdisciplinarity/cross paradigm projects and modernize their programming to enable interdisciplinary research. It should explore a method for evaluation that goes beyond averaging weightings given by reviewers from different fields. The process must be suited to the way research is conducted in the 21<sup>st</sup> century and the complexities of the research questions being addressed.**

**In the short term, CAGS recommends a discrete fund for interdisciplinary research (grants and scholarships) to be managed collectively by the granting councils.**

## Revamping the Review Process

Success in the pursuit of Big Science involves supporting early career researchers and trainees beyond funding.

Young researchers and trainees need to believe in the integrity of the process. They need to know that proposals and applications are reviewed fairly and by those with the demonstrable expertise to adjudicate. Engaged peer review is critical and must include the provision of constructive feedback to applicants. This facilitates a valuable learning experience that will lead to better proposals.

Ensuring the integrity of peer review and valued, just adjudication processes requires leadership from the agencies themselves as they structure and direct the decision making process.

**CAGS challenges all three of the Tri-Agencies to take a leadership role in incorporating best practices in managing competition review processes. This direction will ensure that the best science and scholarship is supported.**



DR. DANIEL BOYCE, DALHOUSIE UNIVERSITY, BIOLOGY.  
DISTINGUISHED DISSERTATION 2014

## Rethink the Formula

Formulaic allocation of the Canada Graduate Scholarships at the master's level based on each university's share of grant and award funding does not consider some key elements. It places emphasis on the research intensity of the institution as determined by tri-agency operating grant funding, while ignoring the number of research master's students enrolled and the demand for research training at a given institution (e.g. CGS-M applicants). This implies that the grant success of faculty is a determinant of attracting high quality students. While this is typically the case for doctoral students, applicant surveys suggest that it is the reputation of the programs that attract master's level students more so than the roster of prospective supervisors. Some recognition of the research master's enrolment base would be welcome.

We do not have a concrete suggestion for modifying the formula other than introducing drivers that reflect the target group of these awards i.e. master's students.

**CAGS would welcome the opportunity to work with the Tri-Agencies to introduce a variable into the formula that would put students at the fore thereby ensuring that awards are granted to the most deserving students drawn from a deep and competitive pool of candidates.**

## Broaden the Scope

Federal Tri-Agency monies fund a significant portion of university research and development, providing the training ground for graduate students. As such, much of students' learning and skill acquisition is tied to specific research environments.



1 DISSERTATION ON THE LAKE, THESIS WRITING SEMINAR

The new reality demands that graduate students be equipped to translate and apply their skills beyond their area of research or discipline. Many CAGS institutions have incorporated this as part of their mission. They offer, and sometimes require students to participate in workshops and courses to develop and hone these "soft" skills. This must be a component of all graduate training.

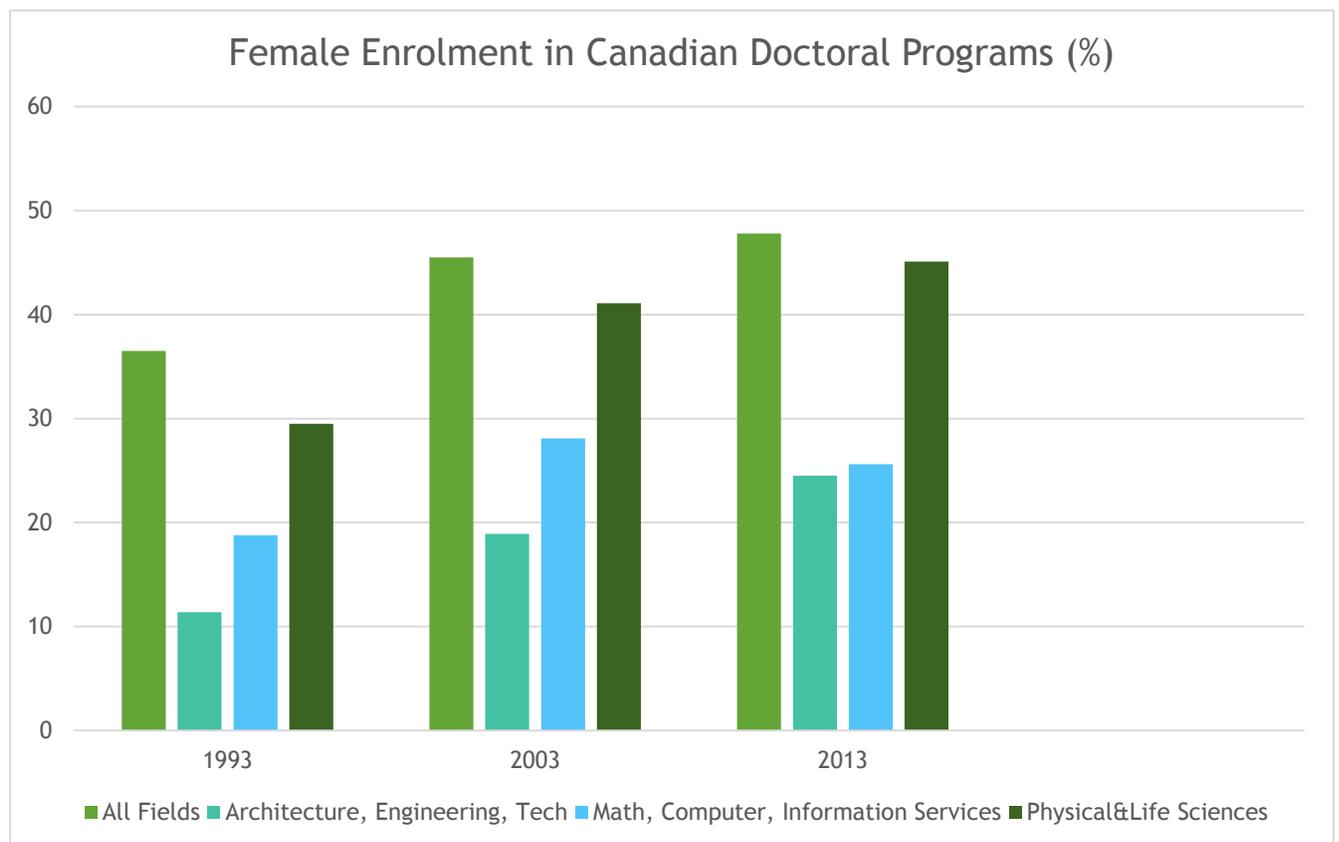
**CAGS recommends that granting councils work with both universities and CAGS to promote the importance of training versatile and resilient graduates, and ensure that the training environment provides opportunities for graduate trainees to translate and apply their learning beyond their own research areas and that of their supervisor.**

## Level the Playing Field

There is an imbalance between men and women in STEM discipline graduate education. For example, enrolment of women in 2013 in Architecture, Engineering & Related Technologies was 24.5% of the total while in Mathematics, Computer & Information Sciences it was 25.6%.<sup>2</sup> Funding policy can help rectify this imbalance.

**CAGS recommends an across the board approach by the Tri-Agencies to review processes with a view to encouraging applications from under-represented groups and eliminating unconscious bias towards women applying for scholarships, fellowships or research grants.**

**CAGS urges the federal government to incorporate into its programming encouragement for all children, regardless of gender, to engage with the sciences.**



<sup>2</sup>Looker, Diane. 41<sup>st</sup> Statistical Report, Canadian Association for Graduate Studies using Statistics Canada data

## Empowering Narrative

Amazing and inspirational stories play out in research labs and in the field every single day. Those stories should be shared in a consistent and accessible way in order to raise awareness of the valuable role Canadian Researchers play in bettering society in all its dimensions. That narrative helps raise support for the role of graduate education and research and can also inspire the next generation to take part. Communication and broad-based dissemination of science should be integral to both the agencies that fund science and institutions that conduct the research. There are excellent initiatives that can set the tone for communications that engage the public-at-large as well as the research communities

- SSHRC Storytellers competition
- NSERC Science Action video award
- NSERC Promoscience initiative,
- The annual CAGS, *Canada's 3 Minute Thesis Competition*

These initiatives are useful, but the audiences are primarily universities (faculty and students) and funding agencies.

Broadening the audience to general and business media, potential industry employers, investors, and the next generation is a strategy that builds on current investment and strengthens the potential for increased engagement.

**CAGS recommends that awardees of Tri-Agency funding (principal investigators and students) be required to present or disseminate their research findings in a general forum in an effort to make their work accessible to the public at large.**



2JOSEPH DONOHUE, WESTERN UNIVERSITY, BIOCHEMICAL ENGINEERING. 2013 3MINUTE THESIS WINNER

Currently, scholarships and grants do not include a clearly articulated expectation or deliverable about public outreach even though the work is supported by tax dollars. Requiring recipients to communicate about their work could have three benefits:

- an opportunity for students to develop communication skills that will serve them well in any career they choose,
- an opportunity to put a public face on publicly-funded research,
- an opportunity to disseminate science in an understandable and meaningful way to a broader public.

Engagement in public forums about science will aid in forming a more positive public opinion about the value of research. Accessible science is important on many levels including recognition that those who conduct the research (graduate students and principal investigators) are valued assets in Canadian society. This may help drive support for more and better science in Canada and inspire the next generation of scientists and researchers.

**CAGS recommends that the Tri-Agencies consider developing mechanisms and tools for the research community to expose research processes to the public and conversely allow the public to openly engage in conversations with the research community. The “[Open Government](http://open.gc.ca)” initiative of the Government of Canada <http://open.gc.ca> could provide a model.**

## Improve the Funding Base

In terms of general financing, CAGS has a number of comments.

As mentioned above, the number of graduate students has increased by 100% over the past ten years. The funds available to the Tri-Agencies have not kept up. Nor have the Tri-Agencies programs kept pace internationally.

**CAGS urges the federal government to continue to increase the financial support for the Tri-Agencies, including expanding their base budgets.**

**CAGS also requests that the Tri-Agencies and the Canadian Foundation for Innovation receive predictable funding going forward. This would permit better planning and more consistent roll out of programs and awards.**

Specifically, in relation to CFI, CAGS is concerned



ANNA MARIA MEDINA RAMIREZ, CONCORDIA UNIVERSITY, BIOCHEMICAL ENGINEERING. 2016 3MINUTE THESIS FINALIST

about the rules around the matching of CFI funds. While the process was developed with the idea that provincial government funds would be available, this is not always the case. Matching from other sources is increasingly challenged and universities do not have the central resources to make up shortfalls. The result is uneven provincial access to CFI and institutional implementation of budget caps to shoehorn into outdated formulas. Either way, the result is a constraint on innovative science.

**CAGS recommends that CFI undertake an analysis of the impact of its rules around matching funds to modernize and promote innovative science.**

## Sounding Boards

In relation to the mandate question about access to advice, CAGS Board of Directors has direct consultations with representatives of the Tri-Agencies a number of times a year. These meetings present an opportunity for both parties to consider operational changes, to provide feedback and to make suggestions. CAGS' Deans and Administrators have had real influence on the way some programs have been rolled out.

**CAGS encourages the Tri-Agencies to make use of the array of boards and committees of existing organizations to test new ideas and make refinements to existing plans.**

Thank you for this opportunity to provide our views.