Next Generation Researchers Initiative
*The National Academies of Sciences, Engineering, and Medicine*

* Canada's Research Environment for Early Career Researchers *

**Final: December 10, 2017**

**Brougham Consulting Inc**

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We would like to acknowledge the helpful comments on earlier drafts received from Ron Daniels, Bryan Thomas, Lida Beninson, Robyn Tamblyn, Bernard Jasmin, Hélène Perrault, Deidre DeJean, Meg McMahon, and Kumanan Wilson. All errors, omission and opinions remain solely ours.

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## DESCRIPTION OF AGENCIES, TERMS AND ABBREVIATIONS

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|---|---|
| CFI | Canada Foundation for Innovation |
| CIHR | Canadian Institutes of Health Research |
| CRCP | Canada Research Chairs Program |
| ECR | Early Career Researcher |
| FRSQ | Fonds de la recherche en santé du Québec |
| GC | Genome Canada |
| GDP | Gross Domestic Product |
| MSFHR | Michael Smith Foundation for Health Research |
| NIH | National Institutes of Health |
| NSERC | Natural Sciences and Engineering Research Council of Canada |
| NSHRF | Nova Scotia Health Research Foundation |
| OECD | Organisation for Economic Co-operation and Development |
| PPR | Project Progress Reports |
| SSHRC | Social Sciences and Humanities Research Council |

# 1 INTRODUCTION

This report examines the barriers that Early Career Researchers (ECRs) face in Canada's research environment, and evaluates the impact on ECRs of policies adopted by the country's leading research funding agencies. It begins by outlining Canada's research funders, including Canada's Tri-Council funding agencies, research and development infrastructure funding, third-party agency funding, and provincial funding agencies. It examines three major federal funding agencies in detail to evaluate how their policies support ECRs: (1) the Canadian Institutes of Health Research (CIHR); (2) the Natural Sciences and Engineering Council of Canada (NSERC); and (3) the Canada Research Chair Program (CRCP). Finally, it identifies some means by which different funders and employers facilitate smooth transitions for ECRs into independent research careers.

This report makes three preliminary observations regarding barriers faced by Canada's ECRs:

1. Research funding has not increased in real dollars for over a decade

2. The elimination of mandatory retirement has led to a decrease in academic hiring and an increase in senior researchers applying for already scarce grants

3. University incentives require researchers to constantly apply for research grants, growing the pool of applicants for any given grant, and ultimately intensifying the pressure on ECRs

# 2 RESEARCH FUNDERS IN CANADA

Canada is home to more than 36 million people, with annual enrolment in post-secondary institutions totalling more than 2.2 million students.[1] Canada has 96 universities, employing more than 45,000 professors and teaching staff,[2] which heavily rely on federal and provincial funding arrangements to support ongoing research and development. There are multiple sources of health research funding in Canada resulting in problems of overlap and fragmentation. On the other hand, differing approaches to research funding policy present opportunities for comparative learning. Universities (and affiliated research institutes, for example, within hospitals) are far and away the most important funders of research, as we discuss further below, but federal and provincial agencies play a critical role. Our mandate in this paper is to focus on federal funders, and we begin our overview with them.

## 2.1 Federal Funding Agencies

In 2015-16, Canada's federal government spent approximately $10.8 billion on scientific research, with approximately $5.2 billion allotted to extramural research (i.e. research conducted at universities, hospitals, and other institutions) – all figures in this report are in Canadian dollars.[3] The CIHR – equivalent to the National Institutes of Health (NIH) – had a 2015-2016 operating budget of $1.03 billion to support health research initiatives.[4] Similarly, NSERC, which supports research initiatives in the natural sciences and

[1] Statistics Canada, "Canadian post-secondary enrolments and graduates, 2014/2015" (*The Daily,* November 23, 2016).
[2] C David Naylor et al., Canada's Fundamental Science Review 2017, "Investing in Canada's Future: Strengthening the Foundations of Canadian Research," Advisory Panel for the Review of Federal Support for Fundamental Sciences, Minister of Science, Government of Canada, at 143.
[3] *Ibid* at 1.
[4] See, CIHR, "2016-2017 Report on Plans and Priorities," (Minister of Health, 2017), available online: <http://cihr-irsc.gc.ca/e/49658.html> (accessed August 3, 2017).

engineering fields, reported a 2016 budget of $1.12 billion.[5] For comparison, the NIH reported a 2015-16 budget of US$30.6 billion. This represents a thirty-fold difference in funding compared to the CIHR and NSERC budgets, despite only a nine-fold difference in population.[6]

*Tri-Council Funding*: Tri-Council funding is the most important source of federal funding for scientific research. The Tri-Council consists of the Social Sciences and Humanities Research Council (SSHRC), CIHR, and NSERC; our report will focus on the latter two, which are the important federal funders of biomedical and health-related research. In addition, the CRCP, a federal initiative intended to strengthen Canada's research capacity through the establishment of Research Chairs, contributes $265 million annually and has resulted in more than 2,000 research professorships since its inception in 2000.[7]

*Infrastructure Funding*: In 1997, the federal government created the Canada Foundation for Innovation (CFI) to invest in state-of-the-art infrastructure projects in Canada's universities, colleges, research hospitals, and non-profit research institutions. Since its inception, the CFI has committed more than $6.7 billion in support of 9,415 projects at 147 research institutions across Canada.[8] The CFI provides support of up to 40% of the total eligible costs of an infrastructure project. The balance of funding has to be provided by the applying university or another eligible partner[9] – although this can be by way of "in-kind" contributions meaning that the CFI contribution of 40% in actual dollars is essential for creating research facilities particularly given the tight fiscal circumstances many universities operate under. Among other initiatives, the CFI partners with the CRCP to support CRC chair-holders with infrastructure and equipment upgrades; to date it has spent over $350 million supporting more than 2,000 Canada Research Chairs projects.[10]

Institutions may use CFI funding for the following: the purchase, shipping and installation of research equipment; software licensing; lab furniture; initial training for operators of the lab; construction or renovation of the research space, including the hiring of contractors and construction personnel; and the acquisition of databases.[11] It is important to note that CFI *cannot* be used for direct stipend/salary support of ECRs such as post-doctoral fellowships.[12] Nonetheless, 97% of CFI grant-holders reported that CFI infrastructure was key to training the next generation of researchers, with more than 23,000 post-doctoral fellows and higher education students working with the CFI-supported infrastructure.[13] It should be also noted that a recurrent criticism for the CFI program is that the CFI does not provide on-going operating funds to sustain the equipment. Again because of limited funds that the universities have themselves to

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[5] NSERC, "Report on Plans and Priorities – 2017," (NSERC, Minister of Innovation, Science, and Economic Development, 2017), available online: < http://www.nserc-crsng.gc.ca/NSERC-CRSNG/Reports-Rapports/RPP-PPR/2016-2017/index_eng.asp> (accessed August 3, 2017).

[6] Naylor, *supra* note 2 at 81.

[7] Goss Gilroy Inc, "Evaluation of the Canada Research Chairs Program" (Ottawa: Prepared for NSERC-SSHRC Evaluation Division, 2016) at 1, online: <http://www.chairs-chaires.gc.ca/about_us-a_notre_sujet/publications/evaluations/Chairs_Evaluation_Report_E.pdf>; and Naylor, *supra* note 2 at 143.

[8] Canada Foundation for Innovation, "2016 Report on Results: An analysis of investments in research infrastructure", (Ottawa, CFI, 2016) at *ii*.

[9] Canada Foundation for Innovation, "Policy and Program Guide", (Ottawa: CFI, May 2013) at 11 and 21.

[10] Canada Foundation for Innovation, "Funding for infrastructure associated with a Canada Research Chair/ Financement de l'infrastructure liée à une Chaire de recherche du Canada", (Ottawa: CFI, 2017) at 1 and 4. For a summary of funding across Canada's universities and corresponding provinces, see online: < https://www.innovation.ca/sites/default/files/pdf/cumulative_totals_may_2017.pdf>.

[11] Canada Foundation for Innovation, "Policy and Program Guide" *supra* note 9 at 13.

[12] *Ibid* at 14.

[13] Canada Foundation for Innovation, "2016 Report on Results" *supra* note 8 at 3.

support infrastructure the end result is duplication of equipment but no funds to operate them in the longer term.

*Other Third-Party Agencies*: Third-Party Agencies are set up arm's length from the federal government and generally receive funding via tailored contribution agreements, renewable on five-year terms.[14] The three largest third-party Canadian agencies are Genome Canada (GC), Brain Canada, and Mitacs (examined in Section 5.1). For example, the federal government established GC in 2000 to administer genome-specific funding, as well as to conduct its own research initiatives.[15] Since its inception, GC has received $1.1 billion from the federal government, and has raised over $1.6 billion through co-funding commitments, for a total investment of $2.7 billion.[16] In 2016-17, GC managed $180 million in funding, with $55 million funded by the federal government, and the remaining $125 million sourced from other partners.[17]

**2.2 Provincial Research Funding Agencies**

In addition to federal research funding programs, the ten provinces and three territories also fund science and health research either directly or (most commonly) through research agencies. For example:

- Québec (population 8.3 million) created the Fonds de la recherche en santé du Québec (FRSQ) which funds $94.2 million per annum for research and training awards and grants, supporting over 1,400 young researchers (including graduate students, postdoctoral fellows, research fellows, and research groups).[18]

- Nova Scotia (population 950,000) established the Nova Scotia Health Research Foundation (NSHRF) which funds $5.5 million per annum to support health research initiatives. In 2016, NSHRF expanded their definition of ECRs from five years to seven years due to increased application demand and to respond to a decrease in success rates for ECRs.

- British Columbia (population 4.7 million) has invested more than $450 million in the Michael Smith Foundation for Health Research (MSFHR) since its inception in 2001, which has supported over 1,600 researchers and 80 research teams.[19]

**2.3 University Funding**

As we mention above and elaborate on further below, universities, colleges, and affiliated research institutes and hospitals themselves pay the lion's share of support for research through payment of salaries and infrastructure. As a recent study conducted for Canada's Fundamental Science Review highlights:

> The majority of salary support for professors and other research staff comes from their institutions (e.g., universities, colleges, research hospitals, research institutes). For universities and colleges, those salaries are heavily subsidized by provincial operating grants in support of their educational missions. A significant level of investment in student scholarships and other forms of financial aid

[14] Naylor, *supra* note 2 at 102. The three largest third party agencies include Genome Canada, Brain Canada, and Mitacs.
[15] *Ibid.*
[16] *Ibid.*
[17] Genome Canada, "Annual Report 2016-2017," (Genome Canada: 2017) at 44, available online: <https://www.genomecanada.ca/en/about-us/corporate-publications> (accessed August 3, 2017).
[18] FRQS, "Facts and Figures," available online: <http://www.frqs.gouv.qc.ca/en/le-frqs/faits-et-chiffres> (accessed August 1, 2017). This includes graduate students, postdoctoral fellows, research fellows, and research groups
[19] MSFHR, "Our Story," available online: <http://www.msfhr.org/about/our-story> (accessed August 1, 2017).

> is also made by institutions, provinces, and the not-for-profit and private sectors, with philanthropy playing a steadily expanding role...[20]
>
> The federal share in [research and development funding in] 2015 still represented only 23.3 per cent of all [research and development] funding for the higher education sector. Fifty per cent came from the higher education sector itself, amounting to $6.37 billion in 2015. Federal officials sometimes argue that this subsidy can be viewed as a form of provincial and territorial matching offset by federal transfers that support health and education programs in the 13 subnational jurisdictions. Provinces and territories, currently engaged in difficult negotiations with Ottawa over the level of health transfers, are unhappy with the federal government's position that in higher education [research and development] as in healthcare, Ottawa should provide only a quarter of the relevant funding.[21]

We also note that there are concerns that governmental funding for research does not provide sufficiently for the indirect costs of research such as building maintenance, administrative personnel and so on: "to date there as been no attempt in Canada to consistently measure and fund the indirect costs of research."[22]

## 3 FEDERAL TRI-COUNCIL FUNDING AGENCIES AND THE IMPACT OF THEIR POLICIES ON ECRS

The focus of this report will be on federal support of ECRs. We begin with a caveat regarding data, and note that federal funding agencies have only recently begun to evaluate their supports for ECRs. For example, until very recently, CIHR did not require applicants to identify their career stage. Thus, our conclusions are tentative given the lack of substantive data on how different policy initiatives support ECRs.

Federal funding for research increased steadily until 2006 and the number of researchers grew by 20%. Since 2006, the amount of research dollars contributed by the federal government has been capped which, with a growing number of researchers and more researchers continuing in their careers post retirements, has resulted in a decline in real research funding.[23] For example, in 2005, 25% of CIHR proposals were funded, while in 2014, the number of proposals funded dropped to an average of 15%. – although the dollar-value per grant increased.[24] Further, in the period from 2006-07 to 2013-14, Canada witnessed a shift away from independent research, which had permitted researchers to determine their own research questions, to more research funded specific priority areas.[25] For example, in the four-year-period from 2012-2013 to 2015-2016, CIHR granted 688 awards of the 4,681 applications for investigator-led research, with an application success rate of just 14.7 %.[26] The Naylor report notes that researchers pursuing their own

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[20] Naylor, *supra* note 2 at 137.
[21] *Ibid* at 33.
[22] CAUBO/ACPAU, "Indirect Costs of Research", October 2013, Indirect_Costs_of_Research-CAUBO_2013.pdf, online: https://www.caubo.ca/wp-content/.../
[23] Naylor, *supra* note 2 at 35.
[24] Jovana Drinjakovic, "Funding changes usher in a dark age for Canadian science," The Globe and Mail, December 15, 2014, available online: <https://www.theglobeandmail.com/news/national/funding-changes-usher-in-a-dark-age-for-canadian-science/article22100092/>.
[25] Naylor, *supra* note 2 at xiv.
[26] *Ibid* at 69 [*Naylor 2017*], see specifically Exhibit 4.5. Note: CIHR's grant application success rate during this period was 14.7%. The other tri-agency granting council rates had much higher success rates: the Natural Sciences and

research ideas (as opposed to strategic or priority calls) saw a decline of available real resources of about 35% per researcher.[27] The current federal government has indicated its commitment to increase research funds – and improve the prospects for a researcher or a team of researchers to apply for funding for their own areas of scientific inquiry - but there has of yet been no significant increase in funding for Canada's granting agencies.[28]

We turn now to evaluate three federal funding streams – CIHR, NSERC, and CRCP – and the impact of their respective policies on ECRs.

### 3.1 Overview of CIHR Policies

Pursuant to the *CIHR Act* 2000, the federal government established CIHR, as Canada's health research investment agency to respond to research needs requiring both investigator-led research and targeted research.[29] CIHR's mandate is to "excel, according to internationally accepted standards of scientific excellence, in the creation of new knowledge and its translation into improved health for Canadians, more effective health services and products and a strengthened Canadian health care system."[30] The CIHR includes thirteen virtual institutes[31] that are each led by a scientific director and in the past were each supported by their own Institute Advisory Boards (although in recent years these Boards have been merged).[32]

As mentioned earlier, the CIHR invests approximately $1 billion each year and three-quarters of CIHR funding supports investigator-driven research, while the remaining one-quarter of funding is earmarked for priority-driven (or strategic) research.[33] Investigator-driven research refers to projects that are developed by researchers themselves, while priority-driven research responds to priorities determined by the 13 virtual institutes and those identified by the Government of Canada (e.g. research targeted at responding to antimicrobial resistance).[34] For both streams of funding, CIHR conducts a rigorous (although in latter years increasingly criticized) peer-review process and only the top-ranked applicants receive funding.[35] Criticisms of the peer review process in recent years have sprung from reforms that eliminated in-person peer reviews in favour of a virtual online system, which some have argued distorts the selection process.[36]

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Engineering Research Council -- 63.4% and the Social Sciences and Humanities Research Council - 25%.[26] The average grant value for a CIHR grant is, however, considerably higher than that awarded at SSHRC or NSERC.

[27] Naylor, *supra* note 2 at xiv.

[28] Kelly Crowe, "Canadian scientists stung by funding cuts have their own reasons to march this weekend," CBC News, April 21, 2017, online: <http://www.cbc.ca/news/health/canada-science-march-cihr-naylor-report-funding-budget-1.4079581> (accessed August 1, 2017) [*Crowe*].

[29] Canadian Institutes of Health Research Act, SC 2000, c. 6 http://laws-lois.justice.gc.ca/eng/acts/C-18.1/FullText.html

[30] *Ibid.* Note: CIHR's mandate is notable in comparison to other council granting agencies as its objectives are wider in scope, while being expected to meet these objectives with a similar operating budget (Naylor 2017).

[31] The thirteen Institutes are Aboriginal Peoples' Health, Aging, Cancer Research, Circulatory and Respiratory Health, Gender and Health, Genetics, Health Services and Policy Research, Human Development Child and Youth Health, Infection and Immunity, Musculoskeletal Health and Arthritis, Neurosciences Mental Health and Addiction, Nutrition Metabolism and Diabetes, and Population and Public Health.

[32]Information found at Canadian Institutes of Health Research, CIHR, online: <http://www.cihr-irsc.gc.ca/e/9466.html>.

[33] *Ibid.*

[34] *Ibid*

[35] *Ibid*

[36] See Paul Webster, "CIHR critics defend face-to-face peer review" (2017) 189: 13 *Canadian Medical Association Journal*, online: < http://www.cmaj.ca/content/189/13/E513.full>. For an overview of the reforms, including the in-person

The 13 virtual CIHR Institutes support ECRs through funds targeted at specific initiatives, for example, to build capacity in research related to Indigenous Peoples. These priority-funding initiatives, however, vary considerably from year to year and between Institutes.[37] Also, because the Institute budgets have been halved in recent years in order to support larger central initiatives (e.g., the Foundation Grant scheme discussed in the next section and SPOR (the Strategy for Patient Oriented Research))[38], the Institutes have had fewer dollars in recent years with which to support ECRs.

### 3.1.1 CIHR's (Limited) Policies for Supporting ECRs

The CIHR's 2017-2018 Departmental Plan highlights growing concerns around support for ECRs.[39] The CIHR defines an ECR as: "[a] researcher who, at time of application, has held a full time research appointment, for a period of zero to five years."[40]. Between 2008-2009 and 2014-2015, the total number of CIHR grants awarded to ECRs decreased 38% from 1302 to 831 grants per year.[41]

Difficulties for ECRs were exacerbated with reforms in 2015 to CIHR's investigator-driven stream of funding. At that time, CIHR split its investigator-driven stream (then called the Open Grants competition) into two streams: the Foundation Grant stream (7-year grants for programs of research, ostensibly for all researchers but in fact for very established senior investigators) and the Project Grant stream (for shorter programs of research). These reforms raised significant concerns for ECRs who have found it difficult to compete in the Foundation Grant scheme and were left to compete for a much smaller pool of funds left residual in the Project Grant scheme.

Earlier this year, in response to these concerns vis-à-vis ECRs, the CIHR shifted a significant share of funding ($75 million or 37%) from the Foundation Grant stream to the Project Grant scheme. It also changed the eligibility criteria for Foundation Grants to clearly exclude ECRs (thus preventing them wasting their time applying for a Foundation grant they had little hope of securing). CIHR also announced that success rates for ECRs applying for Project Grants would be equalized, meaning that the proportion of ECRs funded should match the proportion of ECR applicants to the competition.[42] This amounted to an additional $30 million in funding and an additional 40 grants per year for ECRs.[43] While the additional funding is welcomed by the research community, the continuing low chances of success led to reports of ECRs considering leaving research, academia, or Canada, or delaying applying to CIHR.[44]

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peer review process, see the International Peer Review Expert Panel Report, found online at Canadian Institutes of Health Research, CIHR, online: <http://www.cihr-irsc.gc.ca/e/documents/peer_review_international-report-en.pdf>.

[37] For a list of salary awards over the past five years, see CIHR, available online: <http://www.cihr-irsc.gc.ca/e/196.html> (accessed August 5, 2017).

[38] Naylor, *supra* note 2 at 81.

[39] Canadian Institutes of Health Research, "2017-18 Departmental Plan," Minister of Health Jane Philpott, at 10, available online: <http://www.cihr-irsc.gc.ca/e/documents/dp_2017-18-en.pdf> [*CIHR Departmental Plan*].

[40] Information found at CIHR, specifically, see online: http://www.cihr-irsc.gc.ca/e/34190.html>.

[41] The Association of Canadian Early Career Health Researchers, "Early Career Investigators (ECIs) in Health Research," at 2, available online: <http://www.acechr.ca/uploads/7/8/5/1/78517024/eci_report_cihrsummit_2016-07-11_appendices.pdf> [*ECIs in Health Research*].

[42] CIHR, "Fall 2016 Project Grant results," available online: <http://www.cihr-irsc.gc.ca/e/50313.html>.

[43] Canadian Institutes of Health Research, "2017-18 Departmental Plan," Minister of Health Jane Philpott, at 10-11, available online: <http://www.cihr-irsc.gc.ca/e/documents/dp_2017-18-en.pdf> [*CIHR Departmental Plan*].

[44] The Association of Canadian Early Career Health Researchers, "Early Career Investigators (ECIs) in Health Research," *supra* note 41 at 3.

### 3.2 NSERC Overview

NSERC is the largest of the Tri-Council and was established in 1978 to support university-based research[45] in natural sciences and engineering. NSERC's 2015-2016 budget was $1.12 billion, supporting approximately 11,000 researchers.[46] It has three streams of grants: 'Discovery Grants' (DGs) for postsecondary researchers (both senior investigators and ECRs), 'People Suite Grants' for graduate students and postdoctoral fellows, and 'Innovation Suite' funding for projects that fuse Canadian companies and postsecondary research. DGs absorb the greatest proportion of NSERC's budget: $436 million in 2015-16 (36%) and, as mentioned, support ongoing programs for researchers at all career stages.[47] As we will see in sharp contrast to CIHR, NSERC has adopted a policy of having much higher rates of success but the grants are much smaller, leaving it to individual researchers to leverage off those federal grants to attract other kinds of support, public and private.

Typically, 2,000 DGs are awarded per year out of a total 3,214 applicants. Success rates of between 60-70% are thus dramatically higher than with CIHR grants;[48] however, one of the major drawbacks is that the average amount per grant is relatively low, at less than $35,000 per year.[49] By comparison, CIHR awards are typically greater than $100,000 per year.[50] The limited NSERC funding requires researchers to find additional funding from other programs to supplement their research, and as such, the DGs are considered "grants-in-aid".[51]

#### 3.2.1 Impact of NSERC Policies on ECRs

NSERC defines ECRs as "researchers who are within three years of the start date of an NSERC eligible position, and who have no academic or non-academic independent research experience prior to the three-year window at the time of submitting their Notification of Intent to Apply for a Discovery Grant."[52]

NSERC has recognized in the last few years the importance of supporting ECRs and has implemented a range of policies. For example, NSERC explicitly acknowledges in its application process that ECRs will not have the same level of experience as established researchers. To accommodate for their limited experience, NSERC assesses ECRs at a lower threshold and, whereas senior researchers would not receive funding for proposed research that falls below a particular rating category, ECR applicants may still receive

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[45] Naylor, *supra* note 2 at 174.

[46] Information found at National Sciences and Engineering Research Council of Canada, (NSERC), online: <http://www.nserc-crsng.gc.ca/_doc/NSERC-CRSNG/AuditDG_e.pdf> (accessed July 14, 2017); and Naylor, *supra* note 2 at 174; and for Discovery Grant, People Suite Grants, and Innovation Suite funding breakdown, see table "Budgetary Planning Summary for Strategic Outcomes and Programs," in NSERC, "Report on Plans and Priorities – 2017," (NSERC, Minister of Innovation, Science, and Economic Development, 2017), available online: < http://www.nserc-crsng.gc.ca/NSERC-CRSNG/Reports-Rapports/RPP-PPR/2016-2017/index_eng.asp> (accessed August 3, 2017).

[47] Naylor, *supra* note 2 at 174.

[48] *Ibid* at 86-87 and Exhibit A1.1 at 175. Note: this is the average rate over a four-year period from 2012-2013 to 2015-2016, found at Exhibit 4.5 at 69.

[49] *Ibid* at 86-87].

[50] *Ibid* at 86-87 and Exhibit A1.1 at 175.

[51] *Ibid* at 174.

[52] The three-year application window can be adjusted to take into interruptions in research for instances such as illness, parental leave, etc. Information found at NSERC, online: <http://www.nserc-crsng.gc.ca/Professors-Professeurs/Grants-Subs/DGCategories-SDCategories_eng.asp> (accessed July 14, 2017). Note: the three-year application timeframe is a recent change: it was previously a two-year application timeframe.

funding.[53] Further, to ensure ECRs are assisted fairly in their careers compared to more senior scholars, NSERC has allocated them a minimum 50% application success rate: in fact, in the most recent 2017 DG competition, the success rate for ECRs was 69%.[54] However, the average funding for ECRs was just $25,000. But in addition, ECRs receive an additional $5,000 grant as a top-up.[55] As further support for ECRs, in 2016, NSERC permitted ECRs to extent their first DG by one year, to better help them transition to the next stage of their careers; 84% of eligible grantees accepted the extension.[56]

In comparison to ECR applicants, more senior researchers are evaluated on their track-record only over the last 6 years and not their entire research career; doing so helps permit fairer competition for grants between ECRs and more senior researchers.[57]

### 3.3 Canada Research Chair Program Overview

Launched in 2000, the Canada Research Chair Program (CRCP) is the Federal Government's permanent flagship initiative intended to strengthen Canada's research capacity by offering research chairs (including salary and research support).[58] The program's goal is to retain talented domestic scholars and attract world-class researchers to Canada.[59] The CRCP is a tri-council initiative with a current budget of $265 million per year and allocates its funds to universities to catalyze research excellence.[60] Universities choose whom they wish to nominate to fulfill their quota of CRC Chairs but the application is then externally peer-reviewed through the CRC bureau (the success rate is very high at 91%)

CRCP allocates up to a total of 2,000 Canada Research Chairs to universities, divided into two tiers. Tier 1 Chair awards have a term of 7-years (until 2017 renewable indefinitely, but now limited to two consecutive terms), and are intended to attract world-class researchers that are leaders in their fields.[61] Tier 2 Chair awards, by comparison, have a term of 5 years, are renewable once, and are intended to retain exceptional emerging researchers who are anticipated to become leaders in their field.[62] Tier 1 Chairs are awarded $200,000 per annum, and Tier 2 Chairs are awarded $100,000 per annum.[63] The universities variably top up these amounts with salary bonuses for the research chair, and allocate additional research stipends. Different university policies in this regard can mean that CRCs have very different packages in terms of research support, which in turn may make it difficult for CRCs from less generous or wealthy institutions to compete, for example, with respect to renewal.

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[53] For a sample of the Discovery Grant Merit Indicators which reviewers use to consider applicants, see online: <http://www.nserc-crsng.gc.ca/_doc/Professors-Professeurs/DG_Merit_Indicators_eng.pdf>.
[54] Information found at NSERC, specifically page 3, Table 1 "Overall Comparative Statistics Discovery Grants Competitions, 2013-2017," online: <http://www.nserc-crsng.gc.ca/_doc/Professors-Professeurs/2017DG-RTI_e.pdf).
[55] Note: funding levels for ECRs are more flexible than regular applications. ECRs are evaluated against the same three criteria as established researcher; however, NSERC allows a different quality cut-off for funding of ECRs. For more information, see NSERC online: <http://www.nserc-crsng.gc.ca/Professors-Professeurs/Grants-Subs/DGIGP-PSIGP_eng.asp> (accessed July 21, 2017).
[56] Information found at NSERC, specifically Slide 30, online: < http://www.nserc-crsng.gc.ca/_doc/NSERC-CRSNG/Engagement_2017_Eng.pdf).
[57] A more comprehensive list of criteria and information can be found at NSERC, online: <http://www.nserc-crsng.gc.ca/NSERC-CRSNG/Policies-Politiques/assesscontrib-evalcontrib_eng.asp> (accessed July 13, 2017).
[58] Goss Gilroy Inc, *supra* note 7 at 1,
[59] Naylor, *supra* note 2, at 143.
[60] Goss Gilroy Inc, *supra* note 7 at 1.
[61] *Ibid.*
[62] Naylor, *supra* note 2 at 143.
[63] *Ibid.*

The CRCs are allocated to researchers in all disciplines.[64] As of 2017, there were 773 Tier 1 chair-holders, and 842 Tier 2 chair-holders.[65] The number of CRCs awarded to a university depends on the volume of Tri-Council research dollars that it garners,[66] thus there is strong pressure on universities to encourage researchers to apply for Tri-Council research grants – perhaps even in situations where large grants are not necessarily needed for the purposes of the research.[67] Indeed this may mean that universities are incented to require their researchers to apply for CIHR, NSERC and SSHRC grants in preference to other forms of public and private funding that may be more obtainable.

There have been three rounds of evaluations of the CRCP to date. Most recently, the CRCP was reported in most areas to be "effective, cost-efficient, and relevant.[68] However, the CRCP has been criticized for the lack of diversity and gender bias; 70% of all chair-holders are male, and the CRC is now imposing new guidelines for universities to promote inclusion of woman and visible minorities.[69] Further, although originally envisioned as a tool to recruit overseas researchers to Canada, it seems to have increasingly become a tool for universities to poach from each other. At this point it should be noted that the CRCP has clear limitations for supporting ECRs as even for Tier 2 Chairs: the expectation is normally they already have a tenure track position and a very good track record of publications, etc.[70]

The CRCP is designed, in part, to help train future researchers through a trickle-down effect from leading researchers to up-and-coming trainees, such as highly qualified people (HQP), or researchers in the early stages of their careers.[71] Part of the funding allocation is to support and increase the amount of HQP trained through research in Canadian universities, with the expectation that the quality of training will be improved.[72] However, the reality is that the CRCP funding has stagnated since 2000 and now the funding may cover a chair-holder's salary, leaving fewer dollars for investments in post-doctoral students and so on.[73]

### 3.3.2 Problems with Transitioning For Tier 2 Chair-holders

To the extent the CRCP supports ECRs, it is through the Tier 2 Chairs (although there is no reported data on the percentage of Chairs that are ECRs, all Tier 2 nominees must be within 10 years of the award of their doctorate). In terms of research career progression, it is important to note the age gap between Tier 1 and 2 chair-holders increased by 25% between 2010 and 2014, signifying the presence of what some have referred to as a "valley of death" opening up between ECRs and established researchers.[74] The average age

[64] For example, 45% of Chairs are allocated to NSERC, 35% are allocated to CIHR, and 20% are allocated to SSHRC, see Canada Research Chairs', "Method of Allocating Chairs," available online: < http://www.chairs-chaires.gc.ca/program-programme/allocation-attribution-eng.aspx> (accessed August 17, 2017).

[65] See Canada Research Chairs, "Program Statistics," available online: <http://www.chairs-chaires.gc.ca/about_us-a_notre_sujet/statistics-statistiques-eng.aspx> (accessed August 16, 2018).

[66] See for example, Canada Research Chairs', "Method of Allocating Chairs," *supra* note 64.

[67] See for example, Alberta, Alberta Innovates Health Solutions, "Sustainability Funding Opportunity Program Guide", (Alberta, *Alberta Innovates*, February 2014)

[68] Goss Gilroy Inc, *supra* note 7 at 6,

[69] See Canada Research Chair action plan, and corresponding open letters criticizing lack of diversity and gender roles in CRC program, specifically, see Ted Hewitt's May 10, 2017 "Open Letter to University President from the Canada Research Chairs Program" available online: < http://www.chairs-chaires.gc.ca/program-programme/equity-equite/index-eng.aspx> (accessed August 3, 2017).

[70] Goss Gilroy Inc, *supra* note 7 at 28. Tier 2 Chair nominees must be within a period of ten years since receiving their doctoral degree.

[71] *Ibid* at 2.

[72] *Ibid.*

[73] *Ibid* at 14.

[74] *Ibid* at 31; Naylor *supra* note 2 at 97.

of Tier 1 chair-holders between 2010-2014 was 54.2 years, while the average age for Tier 2 chair-holders was 39.5 years.[75] The source of the gap has been largely associated with the perpetual renewal of Tier 1 Chairs. While the Tier 2 award was not intended to be a breeding ground for Tier 1 awards, the sense is that Tier 2s (and ECRs in those Chairs) lack sufficient support.[76]

The gap between Tier 1 and Tier 2 Chairs, which is expected to widen if left unaddressed, has made the retention of current Tier 2 Chairs a pressing concern.[77] A real or perceived lack of support threatens to cause the departure or dissatisfaction of Tier 2 Chairs at the end of their terms, in addition to diminishing outright the attraction of the Tier 2 award.[78] Evidence from the CRCP's 10th year evaluation suggests that Tier 2 chair-holders may seek positions elsewhere following or perhaps before the completion of the award if they are unable to maintain its advantage (e.g., salary, teaching/administrative release, prestige, personnel supports).[79] Because universities themselves decide which individuals to nominate for Tier I Chairs they may rely on the hope that retiring Tier 1 Chairs will find it difficult to move and instead look to recruit "new blood" for a Tier I appointment in preference to promoting an existing Tier 2 Chair. Altogether, if Tier 2 Chairs are perceived to allow for only short-term benefits, the attraction and retention of ECRs will become more difficult, the effectiveness of the CRCP will be diminished. Eventually it seems universities will need to have in place more robust strategies for transitioning Tier 2 Chairs at the end of their mandate.[80] The CRCP itself may need to temper its requirements for Tier 1 to better accommodate the transition from Tier II (and to improve diversity). For example, CRC 1s requires that the researcher demonstrate an international leadership and recognition for excellence of a level that may be not apparent until about 15-20 years of research experience, thus in effect, some 5 to 10 years after finishing the second Tier 2 mandate.

### 3.3.3 New CERC and C150RC Programs Funding Unlikely to Support ECRs

The CRCP's two new sister programs – the Canada Excellence Research Chair (CERC)[81] and Canada 150 Research Chair (C150RC)[82] programs do not appear likely to provide much support to ECRs. The CERC program awards researchers and their teams up to $10 million over seven years to establish research programs at Canadian universities, with 27 CERCs awarded to date.[83] The C150RC will invest $117.6 million over eight years as one-time funding in celebration of Canada's 150th anniversary. The expectation is that it will result in 15 to 35 new Chairs (at either $350 k per year or $1million per year) for internationally based researchers and scholars. The C150RC program, while open to researchers at all career stages, reviews all applicants in one pool; therefore, it is likely that only a few ECRs would be judged to be competitive.[84] While the merits of attracting world-class scholars to Canada are not to be undervalued,

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[75] Goss Gilroy Inc, *supra* note 7 at 31.
[76] Naylor *supra* note 2 at 143.
[77] M Picard-Aitken et al., "Tenth-Year Evaluation of the Canada Research Chairs Program: Final Evaluation Report" (2010) Submitted to Evaluation Advisory Committee of the CRCP, at 120, online: <http://www.chairs-chaires.gc.ca/about_us-a_notre_sujet/publications/ten_year_evaluation_e.pdf> [*Picard Tenth Year*].
[78] Goss Gilroy Inc, *supra* note 7 at 22.
[79] Picard-Aitken *supra* note 77 at 120.
[80] Picard-Aitken *supra* note 77 at 121; and Goss Gilroy Inc, *supra* note 7 at 30.
[81] For more information, see Canada Excellence Research Chairs, available online: <http://www.cerc.gc.ca/home-accueil-eng.aspx>.
[82] For more information, see Canada 150 Research Chairs, available online: <http://www.canada150.chairs-chaires.gc.ca/home-accueil-eng.aspx>.
[83] For more information, *supra* note 81 and see Naylor *supra* note 2 at xxi and 184 [*Naylor 2017*]. According to Naylor at 184, the CERC budget will increase to a 2017-18 budget of $42.9 million annually.
[84] Science Metrix Inc., "Evaluation of the Canada Excellence Research Chairs (CERC) Program: Final Evaluation Report" (2014) Prepared for SSHRC/NSERC Evaluation Division, at 2, online: http://www.cerc.gc.ca/about-

especially in light of fierce global competition and investment in research, these two programs do not make supporting ECRs a priority.

## 4 BARRIERS FACED BY ECRs

### 4.1 Limited Funding for Research Councils and Application Preparation Costs

As discussed above, funding for Canada's federal research councils has stagnated over the past 15 years. The present federal government has indicated a return to previous funding levels,[85] but to date, there has been no increase in funding for any of Canada's Tri-Council research agencies.[86] In a highly competitive research environment, this makes it more difficult for ECRs to secure the funding they need to establish and progress research careers.

Related to limited funding, there has been growing concern about the burden of red tape involved in applying for a grant.[87] It is estimated to take 169 hours to prepare a CIHR grant application with preparation costs for an application averaging $11,000.[88] For an average researcher, this equates to around 22 days per average application.[89] For many researchers, the time and resources that must be devoted to the grant application process leaves little time for actual research or teaching (and with declining operating budgets there is increasing pressure on ECRs to teach more credits). The burden of application also skews the playing field towards established researchers working with large teams able to work on the myriad documents required for submission in a tight time-frame, as compared to an ECR, applying for the first time, perhaps with little or no support.

### 4.2 Limited Experience, Limited Funding, and Limited Positions Available

ECRs compete in research grant competitions against more senior researchers and are disadvantaged because they have, comparatively, fewer publications, patents and so on. With tightened funding and increased applications, the average age of CIHR principal investigators has increased, as ECRs are unable to secure their first grant.[90] CIHR assessment criteria now stipulates that the applicant's career stage should be factored into the analysis of the application by the peer review committee, but it is not clear to what extent this measure is effective.

It is also worth noting the ever-increasing median age of researchers in tenure track positions. In 2016-2017, assistant professors had a median age of 40, associate professors had a median age of 49, and full professors had a median age of 58.[91] In addition, from the 2010/2011 to 2016/2017 period, the number of full

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au_sujet/publications/evaluation_2014-eng.aspx; Innovation, Science and Economic Development Canada, News Release, 343-291-1777, "New Research Chairs program will bring the world's brightest talent to Canadian campuses" (3 April 2017), online: https://www.canada.ca/en/innovation-science-economic-development/news/2017/04/new_research_chairsprogramwillbringtheworldsbrightesttalenttocan.html.

[85] *Crowe supra* note 28.

[86] See for example, "Building a Strong Middle Class," (*Minister of Finance,* March 22, 2017), available online: <http://www.budget.gc.ca/2017/docs/plan/budget-2017-en.pdf> (accessed August 10, 2017).

[87] Goss Gilroy Inc, *supra* note 7 at 19.

[88] See for example, Canadian Institutes of Health Research, "Evaluation of the Open Operating Grant Program: Final Report 2012," at pages 6 and 58, available online: <http://www.cihr-irsc.gc.ca/e/documents/oogp_evaluation_report_2012_e.pdf>.

[89] *Ibid.*

[90] Naylor *supra* note 2 at 88.

[91] Statistics Canada, "Number and salaries of full-time teaching staff at Canadian universities, 2016/2017" (*The Daily,* April 25, 2017).

professors increased 12.4% associate professors increased 8.8%, while assistant professors declined 8.5%, and the rank below assistant professor declined 2.7%.[92] These statistics may indicate that while salaried positions have overall increased, fewer positions are made available at the early stages of a researcher's career, which is likely linked perhaps to limited funding for new positions and because many older researchers are not retiring. However, it should also be noted that many clinician-scientists and research institute PhDs are not in tenure track positions, so to truly understand the full picture of roles for ECRs we need more fulsome data on these kinds of positions as well.

### 4.3 Aging Researchers

The elimination of mandatory retirement has intensified the competitive pressure on ECRs.[93] Researchers are now continuing their research careers well beyond the age of 65 and, consequently, are claiming a growing proportion of research dollars.[94] Statistics from CIHR suggest that the proportion of applications from ECRs has declined over time while the number of applications overall has steadily increased. That the proportion of ECRs in the competition is declining is likely the result of: a) a proportionate decline in the number of ECRs relative to older researchers and b) low success rates for ECRs. Further, for researchers to achieve progression through university ranks, universities place a heavy emphasis on obtaining Tri-Council research grants, as that in turn impacts on the total funding universities receive. Thus, researchers are incentivized to constantly apply for research grants.

Low success rates may deter ECRs from applying for funding, or indeed from continuing in a research career, particularly in an academic setting. As such this makes the potential for transitioning to non-academic settings even more important, and we turn to this now.

## 5 INSTITUTIONS AND AGENCIES SUPPORTING THE TRANSITION OF ECRS WITHIN ACADEMIC SETTING AND TO NON-ACADEMIC SETTINGS

In this section we turn to consider the different supports available to help ECRs progress through their research careers in academia and, importantly, to transition from academic training to research careers in the non-academic sector (private and public). In Canada, the majority of PhD graduates enter the private or non-profit sectors, with less than 20% of all PhD graduates becoming full professors.[95] Multiple institutions and agencies across Canada help to facilitate emerging researchers into research careers, both in academic and non-academic settings (e.g. government, industry, etc.). But there is no national plan or coordination of provincial and sub-provincial efforts in this regard.

Below are just five examples of agencies/organizations that support ECRs transitioning from academia, or into academia. These examples are meant to provide a slim snapshot of the diversity of bodies helping the transition of ECR into research careers in academic and non-academic settings. Our five examples are Mitacs, Michael Smith Foundation for Health Research (MSFHR), Nova Scotia Health Research

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[92] *Ibid.*

[93] The Ontario Human Rights Code, RSO 1990, c H-19 was updated in 2006 and eliminated mandatory retirement, including those in academic institutions. In addition, in 2012, the federal government amended the *Canada Human Rights Act* RSC, 1985, c H-6 and the *Canada Labour Code* RSC, 1985 c L-2 to prohibit those professions regulated by federal law from setting a mandatory retirement age. Similar acts have been passed in various provinces throughout Canada.

[94] Naylor, *supra* note 2 at 97.

[95] Jessica Edge and Daniel Munro, "Inside and Outside the Academy: Valuing and Preparing PhDs for Careers", online: (2015) The Conference Board of Canada at 16 <http://www.conferenceboard.ca/e-library/abstract.aspx?did=7564>.

Foundation (NSHRF), CIHR, and the University of Toronto (Biochemistry). There are many promising examples here but, unfortunately, no mechanism as of yet to identify the most promising and to ensure diffusion of best practices across Canada.

### 5.1 Mitacs

Mitacs is a national, not-for-profit organization responsible for designing research and training programs. Founded in 1999 to support applied and industrial research in mathematical sciences, Mitacs launched a research internship program designed to increase the number of graduates finding research careers in the private sector. Subsequently, Mitacs expanded its program to include all disciplines.

Mitacs offers several key programs to encourage the transition into private sector research, including the Accelerate program, Elevate program, and Globalink.[96] The Accelerate internship program facilitates research collaborations between industry and academia by offering graduate students and postdoctoral fellows research internships with funding starting at $15,000.[97] Since 2003, Mitacs has orchestrated more than 10,000 Accelerate internships, with almost 50% of former Accelerate interns working in the private sector. The Mitacs Globalink internship facilitates research internships at Canadian universities for international students from priority countries, and sends Canadian researchers abroad. Since 2009, Globalink has brought more than 1,500 students to Canada. The Elevate program is also based on the Accelerate internship model. The Elevate program targets research and development, allowing postdoctoral fellows to lead industrial research, and commercialization projects, whilst also supervising Accelerate and Globalink interns.[98] There are pipelines of funds supporting these programs through Mitacs including from the federal government, provincial governments, universities, and international partners.[99]

### 5.2 Michael Smith Foundation for Health Research (MSFHR) Research Trainee Program & Scholar Program

Since 2001, British Columbia's health research funding agency, MSFHR, has funded more than 1,600 researchers and over 80 research teams through various programs and scholarships targeting ECRs. Two of the most important programs are the Research Trainee Program (RTP), and the Scholar Program.[100]

The RTP program has awarded more than $38 million since 2001, supporting more than 1,200 trainee awards targeting ECRs.[101] The 2017 budget allows for $2.5 million in funding, or at least 20 research trainee awards over the three-year term of the award.[102] The RTP allocates 70% of the total funding to

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[96]For information regarding Mitacs, see generally, online: <https://www.mitacs.ca/en/programs>; and for a recent report on Mitacs, see Canada, Mitacs, "Year in Review 2014", available online: <https://www.mitacs.ca/sites/default/files/year_in_review/2014/Year_in_Review_2014.pdf>.

[97] For the full report on Mitacs 2014-2015 annual review, see Canada, Mitacs, "Annual Report for Industry Canada, 2014-15", (Ottawa: Mitacs, July 31, 2015), online: <https://www.mitacs.ca/sites/default/files/uploads/page/mitacs_industry_canada_annual_report_2014-2015.pdf>.

[98] *Ibid* at 6 and 7.

[99] *Ibid* at 8.

[100] For MSFHR funding information and information regarding funding for awards, see MSFHR, "Funding", online: <http://www.msfhr.org/funding>.

[101] For MSFHR information regarding funding for new researchers and available awards, see British Columbia, MSFHR, "Research Trainee Program", (British Columbia: MSFHR, 2017) online: <http://www.msfhr.org/our-work/activities/trainee-awards>.

[102]For MSFHR eligibility information regarding funding for new researchers and the 2017 Research Trainee Program Guidelines, see "2017 Research Trainee Program Guidelines", (British Columbia: MSFHR, 2017) at 5, online: <http://www.msfhr.org/sites/default/files/2017_Trainee_Guidelines.pdf>.

applicants in four research pillars: biomedical, clinical, health services, and population health.[103] The remaining 30% of funding is allocated to researchers conducting research in five targeted priority areas.[104] Eligible applicants must not have held a PhD degree for more than five years or have been a health professional in active clinical services for more than ten years.[105] An established research supervisor at a British Columbia university must support each applicant.[106]

The MSFHR Scholar Program supports new investigators launching independent research careers by providing salary support for researchers within five years of the start of their first university appointment.[107] Since 2001, MSFHR has granted more than 360 scholar awards worth more than $117 million. The budget for the Scholar Program is approximately $5.8 million, funding at least 13 scholars over a five-year term, providing salary support for $90,000 per year.[108] The host university must use the funds to support the salary of the scholar, buy out time from administrative and teaching responsibilities, and provide stipends and salaries for trainees, post-doctoral fellows, and related research assistants.[109] Similar to the RTP, the scholar award recipient must work on a research project that enhances knowledge translation activities under the MSFHR's four research pillars.[110]

### 5.3 Nova Scotia Health Research Foundation (NSHRF) Establishment Grant for ECRs

The NSHRF Establishment Grant builds research capacity at Nova Scotia's universities for recent doctoral graduates. The Establishment Grant provides funding for the NSHRF's four health research categories, including medical research, health policy research, health outcomes research, and health services research.[111] The program awards a maximum $50,000 per year grant for up to three years for researchers graduating with a doctoral degree with a full-time academic appointment at a Nova Scotia approved institution.[112]

### 5.4 CIHR and CHSPRA Modernizing Experiential Learning

One of the CIHR Institutes (the Institute for Health Services and Policy Research) took upon itself to implement the recommendations of the Canada Health Services and Policy Research Alliance (CHSPRA)

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[103] For a full comprehensive overview of MSFHR eligibility information regarding funding for new researchers and awards available, see British Columbia, MSFHR "2017 Trainee Program", (British Columbia: MSFHR, 2017), online: <http://www.msfhr.org/funding/trainee-program/2017>.

[104] For example, these include: Enhancing access to effective primary health care; services for seniors with complex medical conditions; mental health/ substance use care; services for patients needing surgery; rural and remote health care services. See a full comprehensive overview of MSFHR eligibility information regarding funding for new researchers and awards available, see British Columbia, MSFHR "2017 Trainee Program", *ibid.*

[105] British Columbia, MSFHR, "2017 Research Trainee Program Guidelines", *supra* note 102 at 1.

[106] *Ibid* at 3.

[107] *Ibid* at 1.

[108] British Columbia, MSFHR, "2017 Scholar Program Guidelines", (British Columbia: MSFHR, 2017) at 4, online: <http://www.msfhr.org/sites/default/files/2017_Scholar_Guidelines.pdf>.

[109] *Ibid* at 3.

[110] *Ibid* at 2.

[111] See more generally NSHRF, "About NSHRF" (Nova Scotia: NSHRF, 2017), online: <https://www.nshrf.ca/about-nshrf#Categories>.

[112] The current January 1, 2010 date is a moving target and changes reflect recent graduates. For information regarding the Establishment Grant, see Nova Scotia, NSHRF, "Establishment Grant" (Nova Scotia: NSHRF, 2017), online: <https://www.nshrf.ca/establishment>.

in December 2015 to modernize the health services and policy research training enterprise.[113] Some of the main problems highlighted in the CHSPRA report included a decline in the number of traditional academic positions available, a lack of training programs for positions outside of academia, lack of networking and mentoring opportunities, and lack of awareness of employment opportunities outside of academia.[114] One of the main recommendations was the development of experiential learning opportunities for post-doctoral fellows.[115] The CIHR alongside the CHSPRA launched a three-pronged funding initiative: (i) Start-Up Grants (August 2016); (ii) the Health System Impact Fellowship awards to support multi-year experiential learning opportunities (January 2017), and the Health System Impact Doctoral awards to support experiential learning opportunities for trainees in health services and policy research (launch date, TBC).[116] These awards are intended to complement Canada's research environment and support new learning opportunities. While these programs are relatively new and have not been assessed, they follow similar requirements and goals to those of Mitacs, the MSFHR, and NSHRF.

### 5.5 University of Toronto's Department of Biochemistry's Graduate Program

The University of Toronto's biochemistry department took steps in 2012 to transform its PhD program after it found only 15% of its PhD graduates were ending up in tenure track academic positions, by creating a tailored academic to non-academic transition career course that students could take while completing their programs.[117] The aim of the course is to help PhD graduates transition from academic research settings to private and non-profit research organizations by covering topics including communicating to non-academic audiences, networking, mentorship, and general career guidance. In addition, the course offers optional internship assignments, ranging from four-month, full-time positions to several hours per week for the duration of a year.[118] Feedback from the course, based on exit-interviews, has highlighted an improvement in the transition and career progressions from academic to non-academic research settings.[119] The innovative approach was replicated by the University of Toronto's Immunology Department in 2014, and made mandatory for all immunology PhD students.[120] `

## 6 CONCLUSION: REMARKS AND NEXT STEPS FOR CANADA'S RESEARCH FUTURE

Canada's research environment offers interesting insights and cautions for other countries considering how best to support their ECRs. In Canada, the primary challenges for development of productive research careers are: (1) stagnant levels of research funding which has increased competition for limited dollars as more ECRs emerge from training; (2) an aging population of researchers (particularly since the phasing out of mandatory retirement) who out-compete ECRs in grant competitions because of their track record and experience with grant writing and who continue to apply for grants; and (3), a culture and set of incentives that provides financial rewards to universities that attract more Tri-Council grant dollars which in turn results in increasing requirements on researchers to apply for Tri-Council funding regardless of actual need.

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[113] Canadian Institutes of Health Research, "Canadian Health Services and Policy Research Alliance – Modernizing Training in Health Services and Policy Research", (Ottawa: *Working Group Report,* December 7, 2015) at 4, available online: < http://ihpme.utoronto.ca/wp-content/uploads/2014/12/CHSPR-Alliance_Final_Dec7.pdf>.
[114] *Ibid* at 4.
[115] For information regarding the development of new funding initiatives, see generally *ibid.*
[116] For information regarding the three-pronged funding initiative, see generally *ibid.*
[117] Jessica Edge and Daniel Munro, "Inside and Outside the Academy: Valuing and Preparing PhDs for Careers", online: (2015) The Conference Board of Canada at 80 <http://www.conferenceboard.ca/e-library/abstract.aspx?did=7564>.
[118] *Ibid.*
[119] *Ibid.*
[120] *Ibid.*

Canada has a fractured funding environment for funding of health-related research, which can lead to problems of duplication and undue complexity. However, the upside is that there are natural experiments that can occur. In this regard, it is interesting to compare the two main funding agencies for health research, CIHR and NSERC. In the face of stagnating funding, CIHR's success rates have fallen well under 15% and in response it implemented reforms that benefited senior researchers with significant track records (the creation of the Foundation Grant program). Only recently has CIHR revisited this policy and has now implemented some reforms to try to rebalance the playing field for ECRs. On the other hand, NSERC's approach to stagnating funding has been to "spread the pain", bestowing smaller grants but keeping success rates high, between 60-70%. It has also implemented policy to ensure that if the success rate is (e.g.) 50% overall, that the subset of ECR applications enjoy *at least* this success rate. Further, NSERC has taken measures such as that senior investigators are limited to reporting on the last 6 or 7 years of their career (so that a long track-record does not always trump the track-record of an ECR), and specific top-ups of ECR grants and extensions. CIHR has more recently undertaken parallel initiatives to try to improve the prospects for ECRs

Overall, in our opinion, the approach adopted by NSERC is more supportive of ECRs. Further, the approach also encourages both ECRs and more senior researchers to use federal grants as a base to attract other funding from the public and private sector. CIHR increasingly too demands that applicants demonstrate partnering and leveraging of CIHR dollars but this is formally adjudicated – grants that come forward with sufficient partner funding may be more successful. But this approach misses out on permitting hundreds of researchers to test their own ability to leverage federal granting dollars with other dollars and arguably this top-down approach is not as supportive of creative entrepreneurship as the NSERC approach. It is noteworthy that university researchers collaborate on more than $1 billion worth of research with community and non-profit community groups, in addition to $1 billion worth of research in collaboration with the private sector annually.[121] The federal share of research and development spending in 2015 represented just 23.3 per cent of all funding for the higher education sector.[122] So providing all researchers – junior and senior – a secure, albeit smaller size research pool may help incent this kind of leveraging on the part of individual researchers and teams of researchers. However, the NSERC approach is not without its own concerns: if after the ECR "honeymoon" period has passed, a research has not figured out how to leverage other non-NSERC funding, the competition for what remains of NSERC resources is extremely competitive.

Canada's major research chair program, the CRCP, supports some ECRs as Tier 2 Chairs. Here again, stagnation of funding means that there may be little value-added to one's research program from holding a Tier 2 Chair as it may only cover salary and thus not provide ECRs with the funding needed to recruit graduate students or to buy teaching relief to pursue large research initiatives. Further, there have been problems with transition of Tier 2 Chairs at the end of the second renewal: when there is no further provision made for them, they frequently leave their university in an attempt to find similar research supports elsewhere. We would be remiss not to draw particular attention to the criticism that the CRCP, as well as CIHR and NSERC, have come under regarding the lack of diversity and gender bias in their funding arrangements. While it is not necessarily within the scope of this report to discuss reviewer bias,

[121] See for example, Universities Canada's response to the Government of Canada's Review of Federal support for fundamental science, September 2016, at page 5, available online <https://www.univcan.ca/wp-content/uploads/2016/10/federal-support-for-fundamental-science-submission-oct-6-2016.pdf> (accessed August 3, 2017).
[122] Naylor *supra* note 2 at 33.

Canada's research environment is overwhelming comprised of older Caucasian males.[123] The cycle does not seem soon to break either, as young male scientists are more likely to receive operating grant funding.[124] According to one report, investigators found that female scientists had to have 2.5 times as many impactful publications as male scientists to receive an equivalent score by peer reviewers for scientific competence.[125] This is an area that Canada must improve upon, and it requires granting councils to be cognizant of this apparent bias with regards to ECR funding.

As we have discussed, the federal, provincial and territorial governments, including many research agencies, institutions, and private and not-for-profit organizations, have identified in recent years that support for ECRs remains a challenge. Canada must find increased funding – public and private - to support the research environment as whole, while at the same time establishing targeted programs that support ECRs to build successful research careers that transition between the private and public sectors. Given the fragmented array of funding supports and approaches that exists in Canada, there also needs to be a national strategy to co-ordinate and learn from various initiatives and to disseminate best practices in supporting the pipeline of researchers into academic and non-academic careers. If Canada wants to emerge and remain as a leader in research and development, attracting world-class talent in an environment that supports for ECRs must become its top priority..

[123] Robyn Tamblyn, Meghan McMahon, Nadyne Girard, Elizabeth Drake, Jessica Nadigel, and Kim Gaudreau, "Health Services and Policy Research in the First Decade at the Canadian Institutes of Health Research" (2016) 4:2 Canadian Medical Association Journal 213 at 217.
[124] *Ibid*.
[125] *Ibid*.