Strengthening Canada's Research Capacity: the Gender Dimension

The Expert Panel on Women in University Research

Council of Canadian Academies
Conseil des académies canadiennes

Science Advice in the Public Interest

STRENGTHENING CANADA'S RESEARCH CAPACITY: THE GENDER DIMENSION

The Expert Panel on Women in University Research

THE COUNCIL OF CANADIAN ACADEMIES
180 Elgin Street, Suite 1401, Ottawa, ON Canada K2P 2K3

Notice: The project that is the subject of this report was undertaken with the approval of the Board of Governors of the Council of Canadian Academies. Board members are drawn from the Royal Society of Canada (RSC), the Canadian Academy of Engineering (CAE), and the Canadian Academy of Health Sciences (CAHS), as well as from the general public. The members of the expert panel responsible for the report were selected by the Council for their special competencies and with regard for appropriate balance.

This report was prepared for the Government of Canada in response to a request from the Minister of Industry. Any opinions, findings, or conclusions expressed in this publication are those of the authors, the Expert Panel on Women in University Research, and do not necessarily represent the views of their organizations of affiliation or employment.

Library and Archives Canada Cataloguing in Publication

Strengthening Canada's research capacity [electronic resource] : the gender dimension / The Expert Panel on Women in University Research.
Issued also in French under title: Renforcer la capacité de recherche au Canada.
Includes bibliographical references and index.
Electronic monograph in PDF format.
Issued also in print format.

ISBN 978-1-926558-50-9

1. Women scholars – Employment – Canada. 2. Women scientists – Employment – Canada. 3. Universities and colleges – Faculty – Employment – Sex differences – Canada. 4. Sex discrimination in higher education – Canada. I. Council of Canadian Academies. Expert Panel on Women in University Research

LB2332.34.C3S77 2012 378.1'20820971 C2012-906184-0

Disclaimer: The internet data and information referenced in this report were correct, to the best of the Council's knowledge, at the time of publication. Due to the dynamic nature of the internet, resources that are free and publicly available may subsequently require a fee or restrict access, and the location of items may change as menus and webpages are reorganized.

Statistics Canada data used in this assessment has either been: a) reproduced and distributed on an "as is" basis with the permission of Statistics Canada; or, b) adapted from Statistics Canada. This does not constitute an endorsement by Statistics Canada of this product. Please see: http://www.statcan.gc.ca/reference/licence-eng.html, particularly as it refers to "Acknowledgement of Source" and "No Warranty and No Liability."

Printed in Ottawa, Canada

Council of Canadian Academies
Conseil des académies canadiennes

Canada This assessment was made possible with the support of the Government of Canada.

The Council of Canadian Academies

Science Advice in the Public Interest

The Council of Canadian Academies is an independent, not-for-profit organization that supports independent, science-based, expert assessments to inform public policy development in Canada. Led by a 12-member Board of Governors and advised by a 16-member Scientific Advisory Committee, the Council's work encompasses a broad definition of "science," incorporating the natural, social and health sciences as well as engineering and the humanities.

Council assessments are conducted by independent, multidisciplinary panels of experts from across Canada and abroad. Assessments strive to identify: emerging issues, gaps in knowledge, Canadian strengths, and international trends and practices. Upon completion, assessments provide government decision-makers, academia, and stakeholders with high-quality information required to develop informed and innovative public policy.

All Council assessments undergo a formal report review and are published and made available to the public free of charge in English and French. Assessments can be referred to the Council by foundations, non-governmental organizations, the private sector, or any level of government.

The Council is also supported by its three founding Member Academies:

The Royal Society of Canada (RSC) is the senior national body of distinguished Canadian scholars, artists and scientists. The primary objective of the RSC is to promote learning and research in the arts and sciences. The RSC consists of nearly 2,000 Fellows — men and women who are selected by their peers for outstanding contributions to the natural and social sciences, the arts and the humanities. The RSC exists to recognize academic excellence, to advise governments and organizations, and to promote Canadian culture.

The Canadian Academy of Engineering (CAE) is the national institution through which Canada's most distinguished and experienced engineers provide strategic advice on matters of critical importance to Canada. The Academy is an independent, self-governing and non-profit organization established in 1987. Members of the Academy are nominated and elected by their peers to honorary Fellowships, in recognition of their distinguished achievements and career-long service to the engineering profession. Fellows of the Academy are committed to ensuring that Canada's engineering expertise is applied to the benefit of all Canadians.

The Canadian Academy of Health Sciences (CAHS) recognizes individuals of great achievement in the academic health sciences in Canada. Founded in 2004, the CAHS has approximately 400 Fellows and appoints new Fellows on an annual basis. The organization is managed by a voluntary Board of Directors and a Board Executive. The main function of CAHS is to provide timely, informed, and unbiased assessments of urgent issues affecting the health of Canadians. The Academy also monitors global health-related events to enhance Canada's state of readiness for the future, and provides a Canadian voice for health sciences internationally. CAHS provides a collective, authoritative, multi-disciplinary voice on behalf of the health sciences community.

www.scienceadvice.ca
@scienceadvice

Expert Panel on Women in University Research

Lorna R. Marsden, C.M., O.Ont, (Chair), President emerita and Professor, York University (Toronto, ON)

Janice G. Dodd, Professor and Department Head, Physiology; Professor, Women's and Gender Studies, University of Manitoba (Winnipeg, MB)

Nadia Ghazzali, Rector, Université du Québec à Trois-Rivères; Professor, Department of Mathematics and Statistics; NSERC-Industrial Alliance Chair for Women in Science and Engineering in Quebec, Université Laval (Québec, QC)

Alison M. Konrad, Professor, Organizational Behaviour, University of Western Ontario*; Corus Entertainment Chair in Women in Management, Richard Ivey School of Business (London, ON)

Yvonne A. Lefebvre, FCAHS, Vice-President (Research and Academic Affairs), Providence Health Care (PHC); President, PHC Research Institute; Associate Dean of Research, Faculty of Medicine, University of British Columbia (Vancouver, BC)

Geoffrey Oldham, CBE, Honorary Professor and Former Director, Science Policy Research Unit (SPRU), University of Sussex; Former U.K. Delegate, UN Commission on Science and Technology for Development (Seaford, United Kingdom)

Lynne-Marie Postovit, Assistant Professor, Anatomy and Cell Biology, University of Western Ontario; Canada's Young Researcher Award Winner (London, ON)

Luisa Prista, Head, Environmental Technologies Unit, European Commission's Research and Innovation Directorate-General (Brussels, Belgium)

Wendy J. Robbins, Professor, Department of English, University of New Brunswick; Coordinator of Women's Studies, University of New Brunswick; Former Vice-President, Women's Issues, Canadian Federation of the Humanities and Social Sciences (Fredericton, NB)

Pamela Robinson, Associate Professor, School of Urban and Regional Planning, Ryerson University (Toronto, ON)

Rima Rozen, FRSC, FCAHS, Associate Vice-Principal (Research and International Relations); James McGill Professor, McGill University (Montréal, QC)

* Since the Panel signed off on this report, the University of Western Ontario officially changed its name to Western University.

Karen Sobel, Vice-President, Project Operations, SNC-Lavalin (Calgary, AB)

Veronica Strong-Boag, FRSC, Professor, Women's and Gender Studies and Educational Studies; Founding Director, Centre for Women's and Gender Studies, University of British Columbia (Vancouver, BC)

Lorna Williams, Associate Professor, Faculty of Education and Department of Linguistics, University of Victoria; Canada Research Chair in Indigenous Knowledge and Learning (Victoria, BC)

Michael C. Wolfson, FCAHS, Canada Research Chair in Population Health Modelling/Populomics, University of Ottawa (Ottawa, ON)

Message from the Chair

Throughout history, women have made important contributions to society. Their influence grew as they began entering the workforce in greater numbers and won access to academic institutions at all levels. Over the past three decades the number of top flight female researchers has increased significantly. So in 2008, when the results of the first Canada Excellence Research Chairs (CERC) competition were announced, it came as a surprise to many that not one of the 19 appointed Chairs was female. What could have been a celebrated announcement drew critical national headlines, and a public outcry. In addition, university administrators began to ask themselves some tough questions and do a little soul searching. The Minister of Industry moved quickly to investigate the reasons behind why women had not been selected to receive even one of the world-class research awards worth $10 million over seven years, by appointing an Ad Hoc Panel on CERC Gender Issues, which submitted its report in April, 2010.*

Based on the findings of the Dowdeswell *et al.* report, the Minister of Industry asked the Council of Canadian Academies to further examine the factors that influence the career trajectory and statistical profile of women researchers in Canadian universities. I was honoured to chair the Expert Panel, which was comprised of Canadian and international experts from a diverse set of backgrounds. The Panel's journey was rigorous and intense as we considered both the qualitative and quantitative evidence available to us.

Trying to sort out the evidence has not been easy. Within the constraints of the available data, literature and knowledge, we have gone as far as we could responsibly go to examine the factors that affect women in university research careers, and point to hypotheses. We have also identified key areas for further research that we hope will be taken up by others. We hope this assessment will serve as an important tool for policy-makers and university administrators in the development of new policies and programs that will further women in university research careers.

* Dowdeswell *et al.*, 2010. Report to the Minister of Industry of the Ad Hoc Panel on CERC Gender Issues.

On behalf of the Expert Panel I would like to thank the 13 reviewers who took the time to critique this report to ensure it was a balanced, evidence-based document. As well, I would extend our thanks to the Council's research staff; Elizabeth Dowdeswell, the Council's President; and Janet Bax, our Program Director who ably supported the Panel from the start.

Lorna R. Marsden, Chair
Expert Panel on Women in University Research

Acknowledgements

During the course of its deliberations, the Panel sought assistance from many individuals and organizations who provided valuable evidence and information for consideration. Special thanks to the following: Kathryn McMullen, Louise Desjardins and Darcy Hango from Statistics Canada; Dr. Natalie Kishchuk; Dr. Ann Dale, Canada Research Chair; staff of the Tri-Council and particularly Isabelle Blain, Danielle Menard, and Barney Laciak of the Natural Sciences and Engineering Research Council of Canada (NSERC); Christine Trauttmansdorff and Sarah Moreault of the Social Sciences and Humanities Research Council of Canada (SSHRC); and Christian Sylvain and Bey Benhamadi of the Canadian Institutes of Health Research (CIHR). In addition, valuable contributions were provided by Louise-Michelle Verrier and Valérie Leblond from the Canada Research Chairs Secretariat, Robert Davidson from the Canada Foundation for Innovation (CFI); Herb O'Heron and Caroline Lachance of the Association of Universities and Colleges of Canada (AUCC); James Turk, Linda Rumleski and Robert Johnson of the Canadian Association of University Teachers (CAUT); Dr. Barbara J. Orser, Deloitte Chair in the Management of Growth Enterprises at the Telfer School of Management, University of Ottawa; Lisa Willner of the Federal S&T Community Management Secretariat; Samantha Colasante of Engineers Canada; and Jennifer Flanagan and Virginia Hall from Actua.

Project Staff of the Council of Canadian Academies

Assessment Team:	Janet W. Bax, Program Director Laura Bennett, Researcher Emmanuel Mongin, Research Associate Kori St. Cyr, Research Associate Brianna McGrath, Program Coordinator Wendy Y. Shen, Program Coordinator
With assistance from:	Joanna Odrowaz, Editor NIVA Inc., Copyediting Services Jean Pierre Toupin, Certified Translator, Eng-Fre Accurate Communications, Report Design

Report Review

This report was reviewed in draft form by the individuals listed below — a group of reviewers selected by the Council of Canadian Academies for their diverse perspectives, areas of expertise, and broad representation of academic, industrial, policy, and non-governmental organizations.

The reviewers assessed the objectivity and quality of the report. Their submissions, which will remain confidential, were considered fully by the Panel, and many of their suggestions were incorporated into the report. They were not asked to endorse the conclusions nor did they see the final draft of the report before its release. Responsibility for the final content of this report rests entirely with the authoring Panel and the Council.

The Council wishes to thank the following individuals for their review of this report:

Hans M. Borchgrevink, Special Advisor, the Research Council of Norway (RCN) (Oslo, Norway)

Valerie Davidson, Professor, University of Guelph (Guelph, ON)

Margrit Eichler, FRSC, Professor emerita, University of Toronto (Toronto, ON)

Monique Frize, O.C., FCAE, Distinguished Professor, Carleton University (Ottawa, ON)

Janet E. Halliwell, President, J.E. Halliwell Associates Inc. (Salt Spring Island, BC)

Chaviva Hošek, O.C., President emeritus, Canadian Institute for Advanced Research; and Professor, School of Public Policy and Governance, University of Toronto (Toronto, ON)

Victoria Kaspi, FRSC, Professor, McGill University (Montréal, QC)

Kellie A. McElhaney, Alexander Faculty Fellow in Corporate Responsibility, Haas School of Business, University of California, Berkeley (Berkeley, CA)

Bonnie G. Neuman, Vice-President (Student Services), Dalhousie University (Halifax, NS)

Londa Schiebinger, Hinds Professor of History of Science, Stanford University (Stanford, CA)

W. (Bill) Schipper, Associate Professor, Department of English, Memorial University of Newfoundland (St. John's, NL)

Vianne Timmons, President and Vice-Chancellor, University of Regina (Regina, SK)

Harvey P. Weingarten, President & CEO, Higher Education Quality Council of Ontario (Toronto, ON)

The report review procedure was monitored on behalf of the Council's Board and Scientific Advisory Committee (SAC) by **Susan A. McDaniel, FRSC,** Director, Prentice Institute & Canada Research Chair in Global Population & Life Course, Prentice Research Chair & Professor of Sociology (Lethbridge, AB).

The role of the report review monitor is to ensure that the panel gives full and fair consideration to the submissions of the report reviewers. The Board of Governors of the Council authorizes public release of an expert panel report only after the report review monitor confirms that the Council's report review requirements have been satisfied. The Council thanks Dr. McDaniel for her diligent contribution as review monitor.

Elizabeth Dowdeswell, O.C., President & CEO
Council of Canadian Academies

Executive Summary

The university environment has undergone major changes in the past four decades. Despite decades of women's underrepresentation on campus, gender parity in terms of student enrolment was reached in 1989 (see Chapter 3). Women now outnumber men as undergraduate and master's students, and represent nearly half of all PhD students. Although women have outnumbered men at the student level for over 20 years, these changes have not necessarily been reflected to the extent one would expect in the ranks of the professoriate, particularly at the levels of full professor and senior administration.

There are many reasons for concern at the lack of proportional representation of women in senior positions in all facets of our society, including politics, law, medicine, the arts, business, and academia. The underrepresentation of women in any of these areas is a concern considering the fundamental Canadian values of equality, fairness, and justice, as outlined in the *Canadian Human Rights Act*, the *Canadian Charter of Rights and Freedoms*, and the *Employment Equity Act*. This report focuses on women in academia: the 11,064 women with PhDs who are employed full-time in degree-granting institutions. In comparison, there are 22,875 men in this category (see Table 3.1).[1] Besides educating millions of students, these researchers and innovators are working to address the major issues Canada faces in the 21st century, including climate change, demographic shifts, healthcare, social inequality, sustainable natural resources management, cultural survival, as well as the role Canada plays as an international actor. These contributions are in addition to the basic, or knowledge discovery, research that is one of the main duties of academic researchers. In the knowledge economy, a talent pool of Canada's top thinkers, researchers and innovators is needed to help secure and build Canada's economic edge. The wider the pool is from which to draw, the more perspectives, experiences, and ideas will be brought to the creative process. Arguments for fully including women in research careers range from addressing skills shortages and increasing innovation potential by accessing wider talent pools, to greater market development, stronger financial performance, better returns on human resource investments, and developing a better point from which to compete in the intensifying global talent race.

1 The Panel noted that it is important to keep in mind that many talented women and men are employed in part-time university positions, despite the fact that they are not included in this analysis. Please see the List of Definitions and Abbreviations as well as Figure 5.1 for further discussion of this issue.

This report was initiated by the Minister of Industry as a result of the paucity of women represented in the 2008 Canada Excellence Research Chairs (CERC) program. The results of the 2010 Dowdeswell *et al. Report to the Minister of Industry of the Ad Hoc Panel on Canada Excellence Research Chair (CERC) Gender Issues*, provided further impetus for this assessment. The Council of Canadian Academies was asked to assemble a Panel of experts to answer the following question:

> *What policies and what societal, cultural, and institutional, economic, and other relevant factors influence the career trajectory of women researchers in Canadian universities and underlie gender disparities observed in Canadian university researcher's statistical profile, by discipline area, rank, duty/position/stature, salary, tenure, research funding and any other relevant indicators?*

INTERNATIONAL COMPARISONS

In addition to the central charge, the Panel was tasked with comparing the statistical profile of women in university research careers in Canada to those in other key jurisdictions, such as OECD countries. In general, the pattern of distribution of women researchers, associate professors, and full professors is similar across Canada and several OECD countries (such as the U.S., the U.K., Australia, and the EU average), with a few exceptions (individual EU member states). The higher in the ranks one looks, the fewer women are present in comparison to men. There are, however, differences within ranks that are worth noting (e.g., some countries have more women at the full professor level than others). The Panel also found that the EU and the U.S. have led the way in terms of benchmarking and tracking the progress of women researchers, thereby presenting good practices from which Canada can learn.

ILLUSTRATIVE PRACTICES

The Panel was also asked to identify good practices to attract and retain women researchers. The Panel found ample evidence of these international and national initiatives within governments, universities, schools, and advocacy groups, which are designed to train, hire, retain, and promote women in research. These include:

- strategies to increase the competitiveness of individual women, such as mentorship, scholarships, targeted grants, and outreach opportunities;
- university initiatives that aim to create more flexible and family-friendly environments, such as spousal hiring practices, part-time tenure track positions, after-hours child care centres which provide quality care, and systems of awards for gender-friendly departments;

- government policies and research council programs that aim to remedy systemic issues, such as legislated quotas, employment equity policies, and extending grants to accommodate parental leave; and
- legal action to redress inequalities and injustices.

A key finding from a review of these practices is that rarely does one initiative work in isolation to "fix" a problem or meet an objective. Rather it is a combination of practices and policies that, taken together, can be applied to meet objectives and bring about real change.

THE STATISTICAL PROFILE OF WOMEN IN UNIVERSITY RESEARCH IN CANADA

After a year-long review of several sources, the following messages emerged as a result of the Panel's assessment of data:

1. **Women's progress in Canadian universities is uneven by discipline and rank.** Since 1970, there has been a great deal of positive change in women's representation in post-secondary education. However, women's representation varies by discipline and rank. As of 2008–2009, women formed the majority of enrolled bachelor's (57.1 per cent) and master's (54.5 per cent) students, and were nearly at parity with men at the doctoral level (46.7 per cent); however, only 32.6 per cent of all faculty members were women. In terms of discipline, women faculty members in Canada are best represented in humanities, social sciences and education (HSE) (39.6 per cent) and life sciences (LS) (35.0 per cent). Their numbers are lowest in physical sciences, computer science, engineering, and mathematics (PCEM) (14.8 per cent). Despite gains over the past four decades, there is a great distance to go to approach equity. This is especially true in PCEM, where women enrol in PCEM bachelor's programs in significantly lower proportions (24.0 per cent) than they do in HSE (61.6 per cent) or LS (69.2 per cent). Though women's representation in PCEM disciplines is relatively low, the Panel identified a finding that may have positive implications: cross-sectional data indicate that the proportion of women who enrol in PCEM disciplines at the bachelor's level is relatively similar to the proportion of women at the assistant professor level. This finding speaks to the importance of attracting girls and young women to PCEM disciplines before they enter post-secondary education. Clearly, the factors that affect the career trajectories of women researchers differ across disciplines. Progress cannot be tracked by aggregate numbers alone — it is essential to consider women's representation by discipline, rank, and job status (permanent versus casual).

2. **The higher the rank, the lower the percentage of women in comparison to men.** Canadian census data suggest there is a higher proportion of women who are part-time professors than there are full-time professors. While PhD parity already exists in many disciplines, and women are currently 46.7 per cent of all PhD candidates in Canada, snapshot data from a single point in time indicate that the percentage of women is lower at each ascending rung of the faculty ladder. By rank, women represent nearly half of all sessional instructors and lecturers and 42.6 per cent of assistant professors, but they are only 36.2 per cent of associate professors and 21.7 per cent of full professors. Synthetic cohort data, on the other hand, suggest that the proportion of women in full professor positions generally reflects the proportion of PhD graduates 25 years earlier, albeit with a decrease from the level of associate professor to full professor. This indicates that the passage of time alone will probably not be enough to reach parity — the "glass ceiling" effect. The glass ceiling is also evident at the ranks of senior administration. The specific transitions where there are the greatest decreases in the proportions of women represent the areas of greatest potential for positive change.

3. **In general, the Canadian profile is similar to that of other economically advanced nations.** The profile of women's representation in Canadian universities is strikingly similar to that found in other economically advanced nations including the U.S., and to the average profile across the EU (Figure 3.8). As students, women tend to outnumber men. Their proportions equal off at the doctoral degree level, after which men outnumber women at every increasing academic rank. The differences between ranks are clear. The Panel found that because EU statistics represent an average across the 27 member states included in this analysis, it is essential to note variations by country — especially *within* ranks. Sweden, for example, has a higher percentage of female associate professors than Canada, whereas Germany has a lower percentage of associate and full professors who are women.

4. **The Panel was limited in its ability to analyze all assessment questions in full due to a paucity of Canadian data.** The shortage of comprehensive and longitudinal data from the Canadian government, the Tri-Council, Canadian universities, and the private sector, a lack of gender disaggregated data regarding the critical postdoctoral research period, as well as restrictions to access to some existing data (e.g., Federal Contractors Program data) impeded the Panel's analysis and is a serious barrier to researchers across Canada. The Panel was especially concerned by the chronic lack of attention

to diversity data, including gender, race, ethnicity, indigeneity, disability, and other markers of social location. The paucity of comprehensive Canadian qualitative surveys designed to understand the reasons for the low proportion of women holding full professorial posts also affected the Panel's ability to address the charge. A clear definition of the challenges is needed in order to create solutions and achieve goals.

MAIN POLICIES AND FACTORS THAT AFFECT THE CAREER TRAJECTORIES OF WOMEN RESEARCHERS IN CANADA

The findings described above are a result of several factors that the Panel identified during the course of this assessment. After a review of Canadian and international reports and literature, as well as a qualitative analysis of secondary Canada Research Chairs data, the Panel concluded that the following policies and factors affect the career trajectories of women researchers:

1. **Canada could be doing more to fulfill its national and international commitments to women's rights. In addition to upholding the Canadian value of equality, this would bolster Canada's capacity to engage a diverse pool of talented researchers.** Canada is not meeting its own objectives in relation to gender equity goals as laid out in the *Employment Equity Act*, the *Canadian Human Rights Act* and the UN *Convention on the Elimination of All Forms of Discrimination Against Women* (CEDAW). This is demonstrated by the lack of transparency in equity programs such as the Federal Contractors Program; the underrepresentation of women in the Canada Research Chairs program and their total absence from the CERC program.

2. **The pathway to becoming a researcher is laid before university.** The use of a life course perspective is critical to understand the career trajectories of women researchers. Socialization, schemas, and stereotypes define social roles and expectations, and contribute to the lack of encouragement for girls to forge non-traditional paths. As a result, female students consistently report lower levels of self-confidence in PCEM disciplines than males do. This is despite studies that indicate that the math achievement gap is closing, and that the math achievements of girls and boys are influenced by gender equity at the national level.

3. **Young Canadians lack sufficient knowledge about educational requirements for future careers, as well as a clear understanding of what PCEM careers entail.** Evidence indicates that there is a disconnection between the educational choices some students make at the secondary level and their post-secondary or career goals. Negative perceptions of some research-based careers, a poor understanding of what these careers entail, and a lack of role models who encourage engagement with science and math, appear to be factors behind this finding. These results are particularly relevant in light of research which revealed that 75 per cent of physicists globally considered a career in physics *before* they entered university. Programs that have the goal of increasing student awareness about the possibilities of research-based careers early on, especially in science, engineering, and technology, were identified by the Panel as a promising practice.

4. **The paucity of women in leadership positions makes it difficult for other women to envision themselves as leaders.** The paucity of women in leadership positions can also make it difficult for women to *become* leaders. The higher in the ranks one looks, the fewer women are present in comparison to men in positions such as full professors and presidents of universities, leaders of government agencies, and CEOs of private sector companies. Mentorship and sponsorship initiatives provide women with role models who defy gendered expectations and offer advice and support.

5. **Institutional practices can negatively influence the career trajectories of women researchers.** While preparing successive generations for research careers, universities and their affiliated hospitals and institutes conduct the majority of research in Canada. The transition of the university from a traditional, elite, male-dominated institution to one where new student and faculty demographics prevail has required adjustments in policies, practices, attitudes, and leadership to welcome women and minorities. Yet chilly climates, including the cumulative effects of stereotyping, recruitment, and evaluation biases still remain challenges for some academic women. This can result in the perception that women are undervalued, as indicated by the number one finding of the Panel's re-analysis of Canada Research Chairs data. Illustrative practices that respond to these challenges include actions on behalf of university administrators, such as ensuring transparency in search processes to find candidates for jobs, being sensitive to issues such as subtle biases in hiring, promotion and the allocation of resources, ensuring fairness and credit in the allocation of community service responsibilities, and by implementing policies that encourage the mentorship and sponsorship of new faculty.

6. **For women, a small but persistent salary gap can have significant financial effects over the long term.** This gap cannot be fully explained by age or rank, and has changed little during recent years. Even at the full professor level, women make 95 per cent of what men do. Although this pay gap is smaller than the gender pay gap in general, it is still problematic. Over years of work, this disparity contributes to a substantial pay difference between women and men faculty, and continues to affect income through pension payouts after retirement. Preliminary data indicate that this disparity is especially pronounced for women who are also racialized minorities.

7. **The paid work-family life balance is a particular challenge for women researchers with families.** Compared to men in academia, Canadian data indicate that women tend to have fewer children and American data show that academic women start their families later in life. In addition, women researchers with children tend to be in lower academic positions than men. This comes as little surprise, considering several studies show that women in academia spend more time on child care and other unpaid domestic labour than men. Extra investments in family responsibilities can translate into challenges for women who need to build their professional profile through conferences and networking events outside of regular working hours. While there are some illustrative practices, such as stop-the-tenure-clock initiatives, on-site and after-hours child care, and travel funds for dependents, family-friendly policies are not enough to address this systemic challenge. Simply put, old models of career progression are insufficient for the diversified workforce of today. More flexible models of career progression are an important consideration, including part-time tenure track positions that develop into full-time permanent positions, job-splitting options for couples and others, and modified workloads to facilitate re-entry to academia.

CONCLUSION

To answer the questions posed, the Panel used the data that were available to develop a baseline of information about women researchers in Canada. Within the pages of this assessment, the Panel presents a statistical profile of the current state of women in university research careers by rank and discipline, and provides a preliminary analysis of trends through synthetic cohort studies. In order for readers to understand how women researchers in Canada fare in comparison to women in the United States, Australia, the United Kingdom, and the European Union, the results of the Panel's investigation into the status of women in international research careers are also detailed. In keeping with the life course perspective of this assessment, determinants of selection for research careers before and during

the postsecondary years are discussed; push and pull factors that are present within the university environment are evaluated; and the challenges of the paid work-family life balance for women in academia are analyzed. To provide even more comparative context, the Panel presents their findings regarding the similarities and differences between the general experience of women researchers in academia with those in government and industry.

Overall, the general trajectory of women researchers has improved during the course of the past 40 years. Nevertheless, there remain significant issues and challenges, as evidenced by the paucity of women in the highest ranks of academia as well as their low representation in PCEM fields. There are, it turns out, several trajectories of women researchers, which differ by rank, discipline, and the goals of individuals. It is clear that women are willing and capable members of the research community, and there is some evidence of willingness on the part of both the community and its institutions to evolve. However, continued institutional transformation is also important, in order to offer better support for a more diverse group of scholars and researchers, and to continue to consider new perspectives on what constitutes valuable research and knowledge. This shift is also seen in the dramatic growth of higher education research and development (HERD) expenditures, which have almost doubled (from $5,793 million to $11,174 million) over the past decade alone (see Figure 1.3).

Acknowledging inequity and taking proactive steps to ensure equity are two different things. In order for Canada to undertake steps to maximize its research potential, those efforts must include looking at why women continue to be underrepresented in certain fields in university faculties, and in senior administrative positions in universities. Just as there are many challenges due to the dynamic nature of the social and institutional systems that women researchers encounter throughout their life course, so there are several opportunities for progress. Government has policy, program, and funding tools; the private and non-governmental sectors have funding and workplace tools; and our training and academic institutions have policy and institutional practices that can all play a part in ensuring the greatest advantage is taken of our Canadian talent pool.

The benefits of a diverse research community extend far beyond the walls of universities. We interact with the outcomes of Canadian research projects throughout our daily life. The technology we use at home and in our offices, the schools where our children are educated and the ways in which we think about society all incorporate ideas and outcomes from our great Canadian innovators. A wider pool of researchers can translate into a wider range of excellence, with clear benefits for all Canadians.

Table of Contents

List of Definitions and Abbreviations

DEFINITIONS

Chilly Climate: In 1982, American researchers Roberta Hall and Bernice Sandler coined the phrase "chilly climate" with the publication of *The Classroom Climate: A Chilly One for Women*. In 1996, along with Lisa Silverberg, they wrote *The Chilly Classroom Climate: A Guide to Improve the Education of Women*. In this guide, they define the chilly climate as "the subtle ambiance in which many small inequities can create a negative atmosphere for learning, for teaching, and for fulfilling professional roles on campus."

Employment Equity: In her major report on employment equity in Canada in 1984, Justice Rosalie Abella notes: "Employment equity is a strategy designed to obliterate the effects of discrimination and to open equitably the competition for employment opportunities to those arbitrarily excluded." She goes on to state: "What is needed to achieve equality in employment is a massive policy response to systemic discrimination. This requires taking steps to bring each group to a point of fair competition. It means making the workplace respond by eliminating barriers that interfere unreasonably with employment options." Whereas formal equality mandates the same treatment for all, equity is more flexible, and is based on the assessment of fairness.

Faculty: For the purposes of this report, faculty are considered to be teaching staff who hold a PhD and are employed in public or private degree-granting institutions. The majority of these individuals are employed in full-time positions, as full professors, associate professors, and assistant professors.

About two per cent of all *full-time* faculty are employed as lecturers or instructors (see Table 3.1) (Statistics Canada n.d.d.). However, a significant percentage of teaching staff are employed *part-time* as lecturers or instructors. Women are disproportionately represented in this group (see Figure 5.1). The Panel noted that individuals in these contractually-limited employment positions also conduct research. The Panel also recognized that this larger pool of researchers contains a significant number of researchers who are "lost" from secure employment, with whom this report is ultimately concerned. However, because research is not usually a condition of this type of employment, this population is not included in the Panel's analysis (see Appendix 1, UCASS Data, for further details of this definition).

Gender: According to the World Health Organization, gender "refers to the socially constructed roles, behaviours, activities, and attributes that a given society considers appropriate for men and women" (WHO, 2012). These characteristics can and do vary across societies. Gender is different from sex, which can be defined by the biological characteristics of women and men.

Sex disaggregated statistics are commonly collected (see, for example, the 2011 Canadian Census forms), but many reports, while asking individuals to specify sex (e.g., male or female), use this category to discuss gender and gender differences, thereby conflating sex with gender in their data descriptions (see, for example, the 2010 UN report, *The World's Women* and the 2007 NAS report, *Beyond Bias and Barriers*). The theoretical underpinnings of these concepts and their use are not always clearly defined in all of the sources used in this report. While recognizing the important difference between the concepts of sex and gender, data in this assessment are reported in the format in which they were originally presented (e.g., using sex and gender interchangeably).

Illustrative Practice: A policy or practice with a specific goal to address social and institutional challenges, and respond to program or policy gaps. An array of these practices is more effective than isolated responses.

Researcher: In this report, the definition of a researcher depends on the source of quantitative information (e.g., Statistics Canada or the Association of Universities and Colleges of Canada, etc. See Appendix 1, Statistics Canada Data, for further details). However, the main definition is that offered by the Frascati Manual (OECD, 2002): *Researchers are professionals engaged in the conception or creation of new knowledge, products, processes, methods, and systems and also in the management of processes concerned.* Researchers are employed across several sectors, as opposed to universities exclusively.

Schemas: According to Hewstone *et al.* (2005), schemas are cognitive structures that contain general knowledge about the world. This knowledge can be abstract (representations) or specific (examples). They influence how individuals process and remember information, and help us to fill information gaps. Throughout the course of a day, individuals must make many quick evaluations and decisions — many of which are completed with little active thought. Schemas are mental shortcuts that simplify information and assist in mental processing.

Success: The concept of success is central to the charge submitted to the Panel. There are many definitions of success for university researchers, which may include excellence in teaching, student supervision, research, and service.

Considering the Panel was convened after 100 per cent of Canada Excellence Research Chairs (CERC) were awarded to men the Panel decided that measuring success must be based primarily in terms of achieving equal proportions of women and men in Canadian universities, across rank and discipline. Success therefore includes a critical mass of women in the top levels of university research careers.

Tri-Council: The Tri-Council is composed of three federal granting agencies, namely, the Canadian Institutes of Health Research (CIHR), the Natural Sciences and Engineering Research Council of Canada (NSERC), and the Social Sciences and Humanities Research Council of Canada (SSHRC). These granting councils are the major federal sources of research and scholarship funding in academic institutions in Canada.

ABBREVIATIONS

AUCC	Association of Universities and Colleges of Canada
CAPS	Canadian Association of Postdoctoral Scholars
CAUT	Canadian Association of University Teachers
CCWESTT	Canadian Coalition of Women in Engineering, Science, Trades and Technology
CERC	Canada Excellence Research Chair
CIHR	Canadian Institutes of Health Research
HSE	Humanities, social sciences, and education
EC	European Commission
LS	Life sciences
NSERC	Natural Sciences and Engineering Research Council of Canada
OECD	Organisation for Economic Co-operation and Development
PCEM	Physical sciences, computer science, engineering, and mathematics
PRAGES	Practicing Gender Equality in Science
PSIS	Postsecondary Student Information System
R&D	Research and Development
SED	Survey of Earned Doctorates
SETT	Science, engineering, trades, and technology
SSHRC	Social Sciences and Humanities Research Council of Canada
STEM	Science, Technology, Engineering, and Mathematics
UCASS	University and Colleges Staff System
UNESCO	United Nations Educational, Scientific and Cultural Organization

Part I

Historical and Current Landscapes

1

Introduction

- Understanding and Addressing the Charge to the Panel
- Historical Context
- Changes in the Academic Environment
- Government Responses
- Funding
- The Importance of Accountability
- Equity and the Role of Collective Bargaining
- Approaches
- Conceptual Framework
- Diversity of Researchers
- Illustrative Practices

1 Introduction

Chapter Key Messages

- While many reports have focused specifically on women in science, technology, engineering, and mathematics careers, this assessment employs comparative analyses to examine the career trajectories of women researchers across a variety of disciplines. The Panel was able to respond to the charge using a combination of research methods, but their analyses were sometimes hindered by a paucity of key data sets.
- In an attempt not to simply repeat numerous studies of the past on women in research careers, the Panel used a life course model to examine the data from a new perspective. This conceptual framework enabled the Panel to consider the multidimensional nature of human lives as well as the effects of external influences on the career trajectories of women researchers.
- Women are now present in all areas of research, including those areas from which they have previously been absent. Over time, institutions have become more inclusive, and Canadian governments have created policies and legislation to encourage more gender equity. Collective bargaining has contributed to this process. Clearly, the advancement of women in research positions relies on the contributions of individuals, institutions and government.
- Since the 1970s, there has been major progress such that women have been obtaining PhDs and entering the academy as students and faculty at increasing rates. However, women remain underrepresented at the highest levels of academia, as demonstrated by their low numbers in the Canada Research Chairs (CRC) program, and their absence from the Canada Excellence Research Chairs (CERC) program. There is considerable room for improvement in women's representation as faculty.
- Higher education research and development funding has nearly doubled in the past decade. However, the amount of funding allocated to core grants and scholarship programs varies among the tri-council agencies, with the majority of funds available to researchers sponsored by NSERC and CIHR. This pattern is generally replicated in the Canada Research Chairs and the Canada Excellence Research Chairs programs. As noted in the 2003 Human Rights Complaint regarding the Canada Research Chairs program, women are least represented in the areas of research that are the best funded.

Canadian women's research contributions have been instrumental in developing Canada's social and scientific knowledge base. From the first women to earn PhDs in Canada, Emma Baker (1856–1943) in psychology (Creese & Creese,1998) and Clara Benson (1875–1964) in biochemistry at the University of Toronto in 1903 (UofT, 2012), to Canada's first female nuclear physicist and one of the early discoverers of radon, Harriet Brooks (1876–1933) (Birker, 2011), to the "Sherlock Holmes of Saskatchewan," provincial pathologist and Royal Canadian Mounted Police criminologist Dr. Frances Gertrude McGill (1877–1959) (Library & Archives Canada, 2010), to the first female professor in a Canadian university, botanist Carrie Derick (McGill University Archives, 2003), to feminist political philosopher Mary O'Brien, the list of names is long. Canada's first female astronaut and the world's first neurologist in space, Roberta Bondar (Bondar, n.d.), sociologists Margrit Eichler and Dorothy Smith, and legal scholar Louise Arbour are examples of contemporary researchers whose achievements are recognized internationally.[2]

The presence of women in positions of leadership has been discussed by public figures in Canada for over a century. "I had hoped that we in Canada would have had the great honour of leading in the cause of securing the complete emancipation of women, of completely establishing her equality as a human being and a member of society with man," said John A. Macdonald, the first Prime Minister of Canada. "I say it is a mere matter of time" (Canada, 1885). He was referring to the electoral franchise, of course, but over 125 years later, Canadians are wondering just how long Macdonald thought it would take for women to be recognized as equals in every facet of public life. Others have asked the same question, specifically in the context of women, universities, and leadership. In their 1984 report on higher education, founding President of Trent University, Thomas Symons, and Canadian studies scholar and administrator James Page argued "There can be no question that women ought to have social, economic, political, and cultural equality with men in our society. But they do not. Universities ought to be in the forefront of change in respect to the status of women in our society. But they are not" (Symons & Page, 1984).

2 Canadian women have contributed to research and knowledge building across several disciplines, and they continue to do so (in greater numbers) today. The list of names is too lengthy to mention here, but readers are invited to www.science.ca to read more about Canadian women's contributions to science, and www.famouscanadianwomen.com for a historical timeline of Canadian women's accomplishments in academia and society in general.

While Canadian women contribute to society in numerous ways, this report focuses on a very specific group of women — women in university research positions. Academic careers are limited to a specialized group, but there is diversity in terms of the type and calibre of research career. With this in mind, and in addition to the general profile of women in university research, this report examines the status of women researchers across disciplines. It does not dwell only on the experience of "elite" researchers in the Canada Research Chairs program. It also compares the general situation in universities with that of women in research careers in government and industry, as outlined in the charge to the Panel.

1.1 UNDERSTANDING AND ADDRESSING THE CHARGE TO THE PANEL

In October 2010, the Government of Canada, through the Minister of Industry, asked the Council of Canadian Academies to appoint an expert panel to conduct an assessment of:

> *What policies and what societal, cultural, and institutional, economic, and/or other relevant factors influence the career trajectory of women researchers in Canadian universities and underlie gender disparities observed in Canadian university researcher's statistical profile, by discipline area, rank, duty/position/stature, salary, tenure, research funding and or/any other relevant indicators?*

For comparative purposes, the Panel was also asked to respond to the following sub-questions:

> *How does the statistical profile of women in university research careers in Canada compare to that of women in key jurisdictions abroad?*

> *What are the issues that university researchers may face as they seek to advance their careers, and do these issues differ across the range of discipline areas in the natural sciences and engineering, social sciences and humanities, and health sciences? Do women researchers in government, non-governmental organizations, and the private sector face similar challenges?*

In addition, the Panel was asked to explore how international and national actors have responded to the challenge of underrepresentation of women researchers:

> *Both in Canada and internationally, what are the best practices adopted by universities, funding bodies, academic associations, governments, non-governmental organizations, private sector organizations, and other relevant actors to recruit and retain women researchers, and appoint them to prominent positions?*

This question was initiated as a result of the recommendations of the authors of an April 2010 report to the Minister of Industry regarding the lack of representation of female researchers in the Canada Excellence Research Chairs (CERC) program. In response, this assessment provides evidence and findings. There are no recommendations. Rather, the findings are intended to inform policy initiatives related to support provisions for research and development (R&D) at the federal and provincial levels, as well as the policies and actions of institutions such as university administrations and other organizations concerned with the advancement of women in research.

To undertake the assessment, the Council appointed a panel of national and international experts that included individuals with expertise in academic administration, policy, data collection, and analysis methods in the social sciences, humanities, life and physical sciences, engineering, and the law. Panel Members had backgrounds in academia, government, the private sector, and international organizations. They served on the Panel as individuals committed to providing expert advice, not as stakeholders. As with all Council of Canadian Academies panels, the broad range of expertise provides many perspectives; this Panel was deliberately created to have expertise in a range of topics and not solely gender issues.

Upon creation of the Panel, members invested considerable time to ensure they fully understood their charge, including the scope of consideration and the definition of key concepts. In addition to reviewing background documents, the Panel met with representatives from the Science and Innovation Sector within Industry Canada, and heard presentations from the Tri-Council[3] and the Canada Research Chairs Secretariat. Because there are several ways to describe who researchers are and what they do, the Panel agreed that it was important to agree on a definition of the occupation at the outset of this report. They chose to proceed with the description

3 Canada's three federal granting agencies: the Social Sciences and Humanities Research Council (SSHRC), the Natural Sciences and Engineering Research Council (NSERC), and the Canadian Institutes of Health Research (CIHR).

offered by the Frascati Manual (OECD, 2002): "Researchers are professionals engaged in the conception or creation of new knowledge, products, processes, methods and systems and also in the management of processes concerned."

This definition sets the stage for why Canadians should have an interest in researchers, namely through the roles that they play in knowledge creation and innovation — processes that not only enrich society, but are essential to maintaining Canada's global competitiveness in the knowledge economy.

There is an abundance of commissioned reports on women in post-secondary education and research in Canada, such as the *Wright Commission Report on Post-Secondary Education in Ontario* (Wright, 1971); the *Report of the Committee on the Participation of Women in Science and Technology* (National Advisory Board on Science and Technology, 1989); the *Plan for Advancement of Women in Scholarship* (Royal Society of Canada, 1989); *More than Just Numbers* (Canadian Committee on Women in Engineering, 1992). More recently, reports such as *Women in Science and Engineering in Canada* (NSERC, 2010); *Report to the Minister of Industry of the Ad Hoc Panel on CERC Gender Issues* (Dowdeswell *et al.*, 2010); and *The Royal Society for the Twenty-first Century* (Backhouse *et al.*, 2011) have added to the knowledge base. For the last 40 years, Canada has been trying to account for the differences in women's and men's representation in research careers.

Efforts to address this persistent gap are international. Outside of Canada, women researchers have also been the focus of several significant commissioned reports, such as the European Commission's 2012 report, *Structural Change in Research Institutions: Enhancing Excellence, Gender Equality and Efficiency in Research and Innovation*, as well as their 2009 report, *She Figures*, the American Association of University Women's *Why So Few?* (Hill, 2010); *Beyond Bias and Barriers* (NAS, 2007); *Women in Scientific Careers* (OECD, 2006); and *Science, Technology, and Gender* (UNESCO, 2007).

The Panel noted that many reports have focused on women in science, technology, and engineering research careers (due in part to the fact that women have been significantly underrepresented in these fields) yet relatively little attention has been paid to women researchers in the humanities, social sciences, and education. This is despite the fact that 58.6 per cent of doctoral students in these disciplines are women (see Chapter 3), and that their research contributions have profoundly affected the study of poverty, violence, the welfare state, popular culture, and literature, to note only a few examples. Considering this, the Panel's assessment incorporates a comparative, interdisciplinary analysis, with a focus on the broader category of women in university research. In order to identify the areas where women are the most and least represented,

Panellists compiled data and research that describe where Canadian female researchers are — and are not — in terms of both discipline and rank. Where possible, this study also analyzes the situation of women researchers outside of academia so as to paint a clearer picture of female researchers' career trajectories. Its timely focus on the link between gender and innovation highlights the importance of including a gendered perspective in some areas of research, including research agendas (e.g., women's health). It is hoped that all Canadians, including governments, institutions, and researchers, will use this report now and in the future to track trends in Canadian women's educational and career trajectories, and to note the challenges, progress, and opportunities for positive changes to the status of women in university research careers that are present both nationally and internationally.

1.2 HISTORICAL CONTEXT

The Canadian story of women in higher education has been a tale of challenges and resistance. Canadian institutions prioritized the needs of a select clientele, creating barriers for women and racialized minorities despite their calls for fairness. Few institutions responded eagerly to women's demands for admission, which began in the 1850s. The last decades of the 19th century opened many arts and sciences programs to women, but professional training in law, medicine, and theology, unlike education, favoured "professional gentlemen."[4] Queen's University Faculty of Medicine admitted women early on in 1880, only to reject them shortly thereafter until the 1940s (Queen's, 2003). The presumption of a Toronto political scientist in 1965 that "women in the university are primarily there as a consumptive commodity, to while away their time before marriage" was widely corrosive (Levi, 2003).

However, as highlighted on the first page of this report, pioneers found toeholds in some universities. Resistance in the form of unprecedented equality campaigns in the last decades of the 20th century further challenged the status quo. The introduction of women's and gender studies, like indigenous studies, labour studies, ethnic studies, and other interdisciplinary programs, questioned conventional wisdom, and subsequently generated new and rich bodies of knowledge. The scholarly journal *Atlantis: A Women's Studies Journal* began at Acadia University in 1975. In 1976[5] the federal agency Status of Women Canada was created (SWC, 2012), which provided some limited research funding for new initiatives. In the 1980s, the Women's Program

4 See R.D. Gidney and W.P.J. Millar, *Professional Gentlemen: the Professions in Nineteenth-Century Ontario* (1994).

5 The Cabinet position of Minister Responsible for the Status of Women was created in 1971, and the Office of the Coordinator, Status of Women became a departmental agency in 1976 (SWC, 2012).

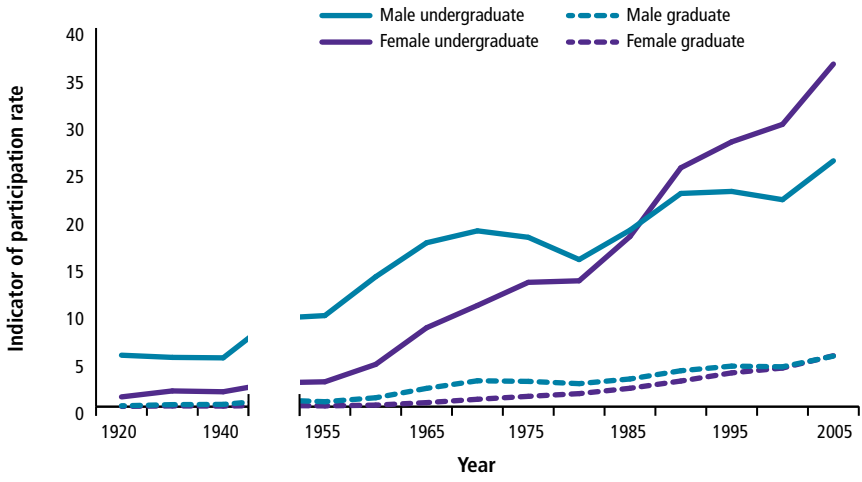
of the Secretary of State for the Government of Canada endowed five regional chairs in women's studies at Mount St. Vincent, Laval, Ottawa-Carleton, Winnipeg-Manitoba, and Simon Fraser universities. Recognizing shifts in scholarly agendas and personnel, a few SSHRC initiatives such as the "Women and Change" program were also created. Toronto sociologist Dr. Margrit Eichler won international acclaim for her *Nonsexist Research Methods: A Practical Guide* (Eichler, 1987) that targeted the biases of androcentricity, overgeneralization, gender insensitivity, and double standards as undermining scholarship and research. The entry of women and other groups into academia, with the enlarged perspective they represent, promised a much more robust research future.

1.3 CHANGES IN THE ACADEMIC ENVIRONMENT

In the last 60 years, the university environment has gone through radical changes. In 1950, total full-time student enrolment was 68,595, and full-time university graduate enrolment was only 4,559 (Statistics Canada, n.d.c.).[6] These numbers remained fairly stable from the end of World War II until the leading edge of the baby boom cohort began reaching university age in the early 1960s (Figure 1.1). By the mid-1970s, total full-time enrolment had increased more than fivefold, while full-time graduate enrolment saw an almost tenfold increase. From the mid-1970s to 2008, full-time graduate university enrolment more than tripled to over 127,000, while total full-time university enrolment more than doubled to about 790,000 (Statistics Canada, n.d.b., n.d.e.).

This growth provides an important context for the discussion of the role of women in university research. Canadian universities have been growing dramatically. Professors who are now in their sixties entered universities when these institutions were one-third or one-quarter the size they are today. In the 1960s, women were a small fraction of the student body; by the late 1980s, there were more female than male full-time undergraduates, and women have recently surpassed men in full-time graduate enrolment. Graduate enrolment has grown about twice as fast as undergraduate enrolment. Correspondingly, the roles of universities have shifted significantly. Up to the early 1960s, the vast majority (94 per cent) of students were undergraduates, but graduate students now make up over 16 per cent of the student body (Statistics Canada, n.d.b., n.d.c.).

6 Statistics Canada data used in this assessment has either been: a) reproduced and distributed on an "as is" basis with the permission of Statistics Canada; or, b) adapted from Statistics Canada. This does not constitute an endorsement by Statistics Canada of this product.



(Data Source: Statistics Canada, n.d.b; n.d.c.)

Figure 1.1

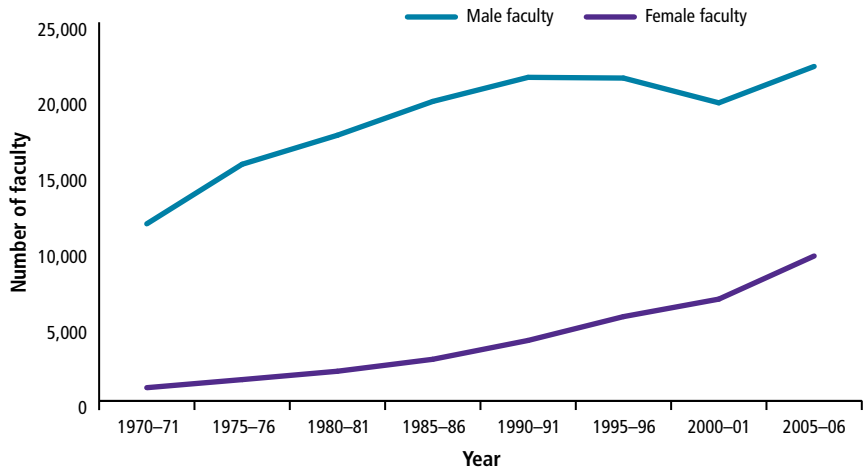
Growth in University Enrolment Since the 1920s

The total number of students, as well as the proportion of women, have been growing dramatically in Canadian universities. In the 1960s, women were a small fraction of the student body. By 1989, there were more female than male full-time undergraduates, and women have recently surpassed men in full-time graduate enrolment. Graduate enrolment has grown about twice as fast as undergraduate enrolment. The number of male and female students has been normalized to the total number of male and female Canadians from 20 to 24 years old.

The number of women as researchers and professors has also increased, although women are still underrepresented at the faculty level. From 1970–1971 to 2008–2009, the number of female faculty members increased by 12.6 times, while the number of male faculty members increased by only 1.9 times (Statistics Canada, n.d.d.). Bear in mind, however, that in the 1970s, a doctoral degree was not necessarily a prerequisite for a faculty position. About 55 per cent of male faculty members had a PhD, as did about 28 per cent of female faculty members (Statistics Canada, n.d.a., n.d.d.). These figures, which are illustrative of the times, are representative of *all* faculty members — regardless of whether or not they had a PhD. For the purpose of this assessment, recall that the Panel chose to analyze the population of women researchers *with PhDs*. Looking within this subset, readers will note that the rate of growth has been substantially slower. From 1970–1971 to 2008–2009, the number of women researchers with

PhDs increased by 4.6 times, whereas the number of men increased by 1.3 times (Figure 1.2) (Statistics Canada n.d.d). While growth in the number of women researchers is important to the goal of gender parity, readers are reminded that because women's representation in 1971 was only a fraction of men's, doubling or tripling these initial numbers would still not put women at numerical parity with men.

Interestingly, during the period in the 1990s when the overall number of faculty decreased, the share of women faculty *increased* (Figure 1.2). The overall reduction of faculty was mainly as a result of retirement incentives and not replacing all of the outgoing faculty (AUCC, 2007). This may have advantaged women since at the time most senior faculty were men and the proportion of women in the pool of PhDs in the 1990s had already increased to about 57 per cent.



(Data Source: Statistics Canada, n.d.d.)

Figure 1.2
Growth of Male and Female Faculty since the 1970s

1.4 GOVERNMENT RESPONSES

From a policy perspective, it is important to note the legislative changes, policy responses, and international agreements to which Canada committed during and since the 1970s. These actions coincided with social change and the movement of more women into universities and research positions. As indicated by these policy responses,

governments have a role to play in addressing inequities. When implemented by the federal government, the provinces, universities, and employers, initiatives of this nature have a significant influence in terms of their ability to encourage wide-scale change.

The Royal Commission on the Status of Women was launched in 1967 to investigate the situation of women in Canada and recommend ways to ensure equality of women and men in Canadian society. The Commission represented an historic moment for equality and preceded a number of policy initiatives directed towards women's equality. By the time the Commision had tabled its report in 1970, members had assembled 167 recommendations dealing with issues such as maternity leave, pensions, and equal pay for work of equal value. Specific recommendations related to women and education were also offered, such as adopting textbooks that portray women and men in a range of occupations, ensuring universities have formal counselling services, and developing provisions to enable women to continue their post-secondary education alongside their family responsibilities (Cross, 2000). Many of these are still being implemented today, but some recommendations, such as a national child care program, have not been fully addressed.

The Government of Canada has been committed to achieving employment equity since 1977 when the *Canadian Human Rights Act* (Canada, 1985) was passed, creating a single law to address discrimination and establishing the Human Rights Commission to ensure compliance in the process (CHRC, 2012). The Act disallowed discrimination in employment and in the delivery of goods and services on 11 grounds, including race, sex, or ethnic origin, within the Government of Canada and in private companies regulated by the federal government. It was understood from the outset that, in order to make any progress, equity required not just treating people in the same way but also introducing special measures to accommodate differences, as well as regular audits to assure compliance. *The Canadian Charter of Rights and Freedoms* was enacted shortly after (Canada, 1982), at the same time as Canada's constitution was repatriated, thereby enshrining the fundamental rights of all Canadians.[7] The Charter, arguably the most significant achievement in Canada's history of human rights, acknowledged the basic freedoms, democratic rights, legal rights, mobility rights, and equality rights of all Canadians regardless of "race, national or ethnic origin, colour, religion, sex, age or mental or physical disability" (Canada, 1982).

Established in 1983, the Royal Commission on Equality in Employment represented another important step towards workplace equality. Upon the release of the Commission's report in 1984, Justice Rosalie Abella concluded that existing legislation

7 Section 15 of the Charter, *Equality Rights*, came into effect in 1985.

and voluntary measures on behalf of organizations were not enough to mitigate the effects of systemic discrimination against women and other minority groups.[8] In response, the *Employment Equity Act* was passed in 1986 and then revised in 1995 (Canada, 1995). Under the Act, federally regulated workplaces must commit to reducing disadvantages experienced by members of the four designated groups — women, Aboriginal peoples, persons with disabilities, and "visible minorities" — by analyzing their workforce, identifying barriers, implementing an Employment Equity Program, and monitoring progress (Leck & Saunders, 1992). Research suggests that formal, comprehensive and supported employment equity programs tend to encourage more representative hiring (Leck & Saunders, 1992) and diminish wage gaps (Leck *et al.*, 1995).

Without these major pieces of legislation, the arrangements that Justice Abella had deemed "insufficient to overcome the pervasiveness of discrimination in the Canadian workplace" (Leck & Saunders, 1992) would have likely continued, resulting in very different trajectories for women with career aspirations. In terms of international commitments, both the *Universal Declaration of Human Rights* (UNGA, 1948)[9] and the 1979 *UN Convention on the Elimination of All Forms of Discrimination against Women*[10] include articles that pertain to public participation and equality (UNGA, 1979).

Substantial evidence from organizational behaviour literature[11] from many countries, including Canada, shows a positive association between government employment equity programs and improvements to employers' systems of recruitment, selection,

8 The 1984 report references the Canadian Charter of Rights and Freedoms, which recognizes that "it is neither discriminatory nor a violation of the equality guaranteed by section 15(1) to attempt to improve the condition of disadvantaged individuals or groups, even if this means treating them differently." This speaks to the "paradox at the core of any quest for employment equity" that Abella cites: "because differences exist and must be respected, equality in the workplace does not, and cannot be allowed to, mean the same treatment for all." Whereas formal equality mandates the same treatment for all, equity is more flexible, and is based on the assessment of fairness.

9 Including the right of all people to participate and share in the arts and scientific advancement (Article 27).

10 For example, Article 5 stipulates that states shall take all appropriate measures to eliminate prejudices and practices which are based on gender hierarchies or stereotyped roles for women and men. Article 10 outlines that states shall work to eliminate "any stereotyped concept of the role of men and women at all levels and in all forms of education," and Article 11 highlights the need for signatories to encourage the provision of the necessary services, "in particular through promoting the establishment and development of a network of child-care facilities," to enable parents to combine paid work and family responsibilities.

11 While much of this evidence comes from government and private sector employers, many of these studies focused on professionals. As such, the findings are likely to generalize to academics in the university context.

compensation, and career development (Konrad & Linnehan, 1995; Holzer & Neumark, 2000; Leck *et al.*, 1995; French, 2001). Further, the vast majority of studies document a significant positive link between diversity management practices and the employment of designated groups across a variety of occupations, including professionals and managers (French, 2001; Konrad & Linnehan, 1995; Holzer & Neumark, 2000; Moore *et al.*, 2010; Woodhams & Corby, 2007).

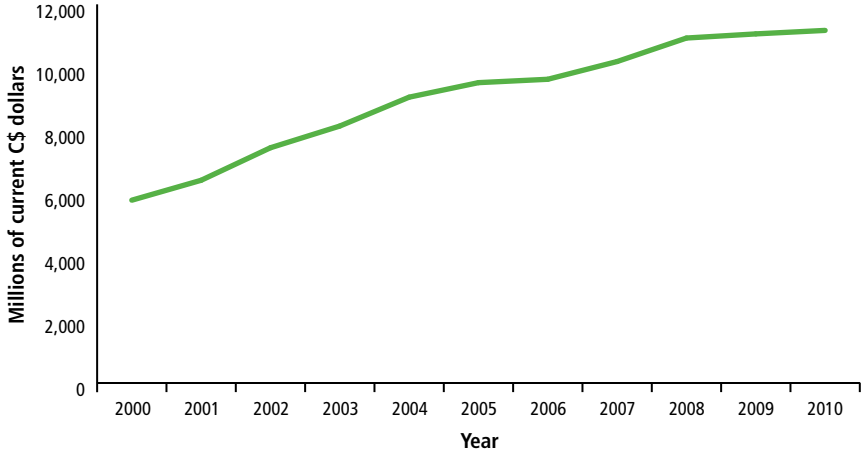
American research suggests that holding organizational leaders accountable for implementing equity practices is a particularly effective way of enhancing the diversity of employees (Kalev *et al.*, 2006), indicating that reporting and monitoring mechanisms are key to success. The Panel observed that meeting these commitments requires the proper implementation of accountability mechanisms, such as reporting and monitoring schemes.

1.5 FUNDING

Over the past decade, there has been dramatic growth in higher education R&D expenditures (performing sector) in Canada. These figures have nearly doubled (from $6,424 million to $11,257 million) in a relatively short time frame (Figure 1.3, Statistics Canada, 2010).

However, the amount of funding allocated to core grants and scholarship programs varies among the tri-council agencies. For example, in 2009–2010, SSHRC core grants and scholarship programs totalled $178.86 million, whereas core grants and scholarships totalled $751.35 million at CIHR and $798.00 million at NSERC (J. Halliwell, 2012; personal communication[12]). While it is simply more costly to conduct research in some fields than in others (as a result of labs, equipment, travel costs, and research teams), this funding arrangement holds significance for women researchers, as well as for perceptions of prestige. As will be described in Chapter 3, women researchers tend to be concentrated within certain disciplines. However, these are not the disciplines that are financially prioritized. When the government sets its research priorities, it may inadvertently disadvantage women because they are less represented in these fields.

12 With data provided by SSHRC.



(Data Source: Statistics Canada, 2010)

Figure 1.3

Research and Development Expenditures in Higher Education from 2001 to 2010

This graph illustrates gross domestic expenditures on research and development in higher education (performing sector) (in current dollars).

The Canada Research Chairs and the Canada Excellence Research Chairs Programs

Similarly, while 80 per cent of Canada Research Chairs are distributed among researchers in NSERC and CIHR disciplines, SSHRC Chairs represent only 20 per cent of the total — despite the fact that the majority (60 per cent) of the Canadian professoriate come from SSHRC disciplines (Grant & Drakich, 2010). Box 1.1 describes the gendered implications of this distribution, as well as the history of the program.

In addition to the Canada Research Chairs program, the Canada Excellence Research Chairs program was launched in 2008. This prestigious program attracts world-renowned researchers with the promise of up to $10 million in funding over seven years to establish research programs at Canadian universities. They are among the most generous awards available globally (CERC, 2011a). For example, in November of 2011, the federal government committed $53.5 million over five years to support the creation of 10 new Chairs (CERC, 2011b). In comparison, the 2012 Canadian Budget proposed to allot $37 million in new funding annually to the tri-council agencies, which support thousands of Canadian researchers (Canada, 2012).

Box 1.1
Canada Research Chairs Program: A History

In 2000, the Government of Canada established the Canada Research Chairs program with the goal of creating 2,000 funded research positions in degree granting institutions across the country. Each year, over $300 million is invested into attracting and retaining talented researchers who excel in the natural sciences, health sciences, humanities, and social sciences, with the goal of improving the quality of life of Canadians, enhancing international competitiveness, broadening the knowledge base, and training new researchers (CRC, 2011a).

Since its inception, the program has been criticized for its focus on the natural sciences, engineering, and life sciences, as well as the lack of targets or equity guidelines. In the program's first full year, women represented only 14 per cent of Chairholders (CRC, 2006). In 2003, eight women presented a human rights complaint against Industry Canada to the Canadian Human Rights Commission. They alleged that contrary to section 5 of the *Human Rights Act*, the Canada Research Chairs program was discriminating against academics who are members of the protected groups as set out in section 3 (see Morgan, 2003, for the full text of the complaint). A negotiated settlement agreement, which was reached in 2006, required that the federal government's policies on non-discrimination and employment equity become a central part of the process (Griffin Cohen v Her Majesty, 2006).

As a result of the settlement, the Canada Research Chairs program has worked with universities to ensure universities follow open, transparent, and equitable recruitment practices and establish equity targets for the representation of the four designated groups (including women, Aboriginal peoples, persons with disabilities and members of "visible minorities") (CRC, 2011b). As of March 2012, the percentage of women awarded Chairs has increased to 25.6 per cent (CRC, 2012b).

The unequal division of funding across disciplines is even more pronounced in the CERC program than the Canada Research Chairs program. In the first round of the program, none of the 19 chairs was awarded to any researcher in humanities, social sciences or education,[13] and none of the grantees was a woman. There are expectations in terms of the effects of research outputs from projects in

13 See http://www.cerc.gc.ca/cpch-pctc-eng.shtml for the list of CERCs.

different fields. For example, two of the four key objectives of the CERC program are 1) to establish Canada as a location of choice for leading research in science and technology development, and 2) to help Canada build a critical mass of expertise in the priority areas outlined in the Government of Canada's science and technology strategy, including: environmental sciences and technologies, natural resources and energy, health and related life sciences and technologies, and information and communications technologies (CERC, 2011a).

In 2010, Dowdeswell *et al.* reported to Canada's Minister of Industry on the lack of female representation in the program. They found that some structural aspects of the CERC program may have affected the ability of universities to present qualified female candidates, and recommended that universities should have to report on outreach to potential female candidates; that program design be altered to include another stream for rising stars (similar to the structure of the Canada Research Chairs program); that multidisciplinary approaches should be encouraged; and that an "open" category for projects outside of the scientific priority areas should be included (Dowdeswell *et al.*, 2010). In addition, they emphasized the link between equity and excellence, in that equity ensures the largest pool of candidates, without affecting the quality of a selection process that is based on excellence.

On a positive note, the Panel noted that the 2006 Canada Research Chairs Settlement Agreement has appeared to encourage the implementation of equity measures in the CERC program, as evidenced by the following text:

> "All CERC recruitment and nomination processes at universities must be transparent, open and equitable. In particular, these processes must include open advertising, with a statement of commitment to equity in the nomination process. Universities are asked to demonstrate exemplary recruitment and selection processes to ensure an inclusive and comprehensive candidate search and equitable selection process. The recruitment and outreach strategy of the nominating institution will be assessed in both phases of the competition" (CERC, 2012).

In addition, for the 2012 competition, at least three of the CERC awards will be made in fields relevant to the digital economy, which falls under the priority area of information and communications technology. At least one Chair will be allocated in each of the remaining three priority areas, and importantly, four remaining Chairs will be open to all areas of inquiry. While this could include any of the science and technology priority areas it may also include "any other areas of benefit to Canada" (CERC, 2012).

The Panel is hopeful that the results of these measures will be reflected in future CERC appointments.

1.6 THE IMPORTANCE OF ACCOUNTABILITY

As evidenced by their increasing numbers as students and faculty, Canadian women have broken down several social and institutional barriers since their early quest for entrance into universities. Legislation has forced institutions to comply with measures of equality and equity, and more women than ever are working outside of the home. However, as evidenced by the dearth of women in some research careers, there are still obstacles to overcome. An example of a federal program where more could be done to fulfill equity mandates is the Federal Contractors Program (1986). This program applies to organizations with more than 100 employees who want to bid on federal government contracts of C$200,000 or more (HRSDC, 2011). To qualify for such a contract, contractors must sign a Certificate of Commitment to implement a workplace employment equity program (HRSDC, 2011). As Canadian universities have increasingly bid on contracts for federal government research and work, they have had to demonstrate compliance with the provisions of the Federal Contractors Program, or at least show that a plan is in place to meet these provisions.

However, the Panel was concerned that although follow-up reviews of employers who have been found in compliance have been conducted since 2005, a comprehensive database is yet to be developed.[14] The absence of longitudinal data represents a major barrier to assessing the efficacy of the program. In addition, the Panel was not granted access to information regarding compliance reviews conducted by federal departments due ostensibly to privacy concerns.[15] In a 10-year review of the *Employment Equity Act*, the Canadian Association of University Teachers (CAUT) recommended that while personal information must be protected, workplace surveys and reports from contractors should be publically available. They argue that "there is no sound rationale for keeping this information and data confidential," considering compliance with the Act and the program is in the public interest (CAUT, 2006a). The Panel echoes these conclusions, adding that access to information should increase program recognition as well as promote compliance.

1.7 EQUITY AND THE ROLE OF COLLECTIVE BARGAINING

A note should be included about the role of collective bargaining in building gender equity in Canadian universities. In Canada, Status of Women committees at the university level (either specific to the faculty union or association, or university-

14 Email correspondence with HRSDC employee, October 19, 2011.
15 Email correspondence with HRSDC employee, July 22, 2011.

wide) and the provincial and national levels have also advocated for equity issues (Varpalotai, 2010). As of 2010, 41 of 47 eligible faculty associations were unionized across Canada, and even for non-unionized faculty associations, collective bargaining is the norm (Varpalotai, 2010). Most collective agreements have articles on equity, including employment equity on campus, discrimination and harassment, promotion and tenure, and appointments, with which unions can both monitor and ensure compliance (Varpalotai, 2010). While several Canadian universities have comprehensive agreements, one illustrative example is the University of Western Ontario's Faculty Collective Agreement (2010–2014). Negotiations have ensured that the university will provide on-campus child care facilities and a family care office; promotion and tenure decisions shall be delayed for one year following pregnancy or parental/adoption leave; and faculty members who return from parental leave may apply for a reduced workload (UWO, 2010). In addition, the existence of equity offices or human rights offices with formal policies are found at institutions across the country, indicating that some universities are beginning to ask whether their workplaces and learning environments are safe and equitable. Low budgets, inadequate reporting, and, too often, failure to prioritize equity remain pervasive problems for unions and other bargaining agents.

1.8 APPROACHES TO THE ASSESSMENT

Coming from a variety of disciplinary backgrounds, Panellists brought with them a range of methodological expertise and preferences. Through a combination of quantitative and qualitative data, the Panel was able to identify and analyze factors that affect the career trajectories of women researchers in Canada (see Appendix 1 for full details). In addition to an extensive literature review of the national and international research and evidence related to the topic, the Panel collected information in the form of data sets and statistics, heard from expert witnesses, conducted interviews with certain stakeholders from academia and industry, and analyzed interview and survey results from their secondary analysis of Canada Research Chairs data (see Appendix 5 for a full description of methodology and results). Together, these methods contributed to the balanced approach that the Panel used to understand the status of women in Canadian university research careers.

In addition, the Panel took an innovative approach to painting a more vibrant picture of the experience of women professors by incorporating examples from academic "life-writing." Life-writing is the generic name given to a variety of forms of personal narrative — autobiography, biography, personal essays, letters, diaries, and memoirs.

Publishing personal testimony is a vital strategy for marginalized groups to claim their voices and tell their own stories, and academic women's life-writing adds vital evidence to a study of women in university careers (Robbins *et al.*, 2011). The first study of academic life-writing appeared in the U.S. in 2008 (Goodall, 2008); as yet, none exists for Canada.[16] Recognizing the benefits of this approach, which focuses on the importance of women's voices and stories, the Panel chose to weave personal narrative from women academics throughout the body of the report to illuminate the subject matter. As with the data gleaned from the Panel's secondary analysis of Canada Research Chairs data, these cases highlight the experience of an articulate and determined minority of women who are prepared and positioned to speak out about structural and personal inequities. More comprehensive surveys are required to establish the precise extent of the problems they so effectively illustrate.

Despite the extensive literature on the subject, the Panel identified some data limitations. While these limitations made some analyses difficult, the Panel was able to effectively respond to the charge by using the combination of research methods described above. Data limitations identified by the Panel include:

- relatively little research specific to the Canadian context;
- lack of longitudinal data;
- relatively few studies (both quantitative and qualitative) dealing with fields such as the humanities and social sciences;
- lack of data on diversity in Canadian academia, including intersectional data;
- lack of comprehensive data and evidence from the private and government sectors; and
- difficulty in comparing some international data due to differences in disciplinary classifications.

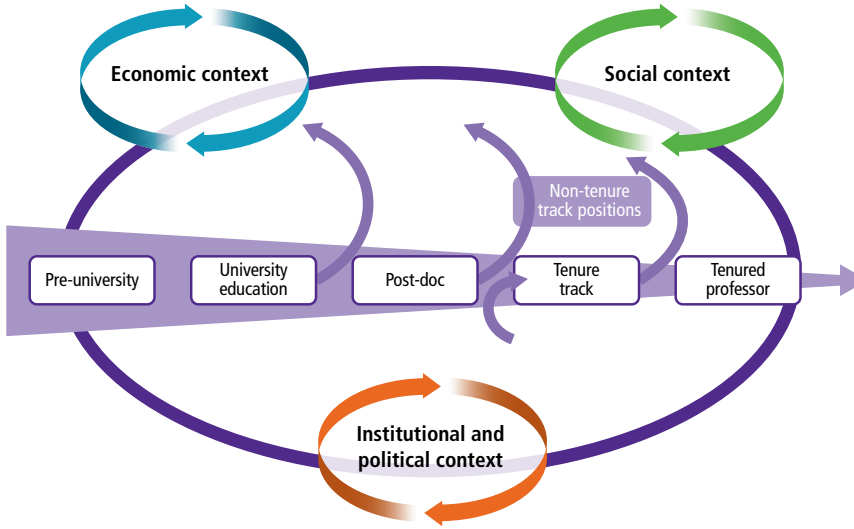
The lack of longitudinal data was particularly frustrating to the Panel. Longitudinal data, as opposed to cross-sectional (or single-point-in-time) data are useful for tracking trends over time. These data would highlight the career trajectories of university faculty in Canada over a number of years. There may be obvious transition points when women researchers leave their university careers — and where policy changes could be implemented. However, the absence of these data impeded this type of analysis. The lack of data on the diversity of researchers was also a major concern

16 However, several collections of personal essays and life-writing such as *The Madwoman in the Academy: 43 Women Boldly Take on the Ivory Tower* (Keahey & Schnitzer, 2003), *Women in the Canadian Academic Tundra: Challenging the Chill* (Hannah *et al.*, 2002), and *Minds of Our Own* (Robbins *et al.*, 2008) highlight women's experience in Canadian academia through their own words.

for Panel Members (please see Section 1.10 for an extended discussion). These data would facilitate a better understanding of the statistical profile and experience of all women researchers.

1.9 CONCEPTUAL FRAMEWORK

In order to study those factors that influence the statistical profile of women researchers in Canadian universities and to address why women continue to be underrepresented in some academic fields, especially in the best-funded areas of research, the Panel designed a conceptual framework. This framework illustrates the typical career path of a university researcher in Canada, defines the main external factors at work, and shows how they are related (Figure 1.4).



(Council of Canadian Academies)

Figure 1.4

The University Researcher: A Life Course Perspective

This figure depicts the career path of a typical university researcher in Canada, as well as the external context that can influence her or his trajectory. Note that, while the source population at the pre-university level is large, the bar narrows as we look further down the life course. Arrows, pointing away from the research career path, symbolize the loss of potential candidates who change trajectories due to different factors encountered along the journey to becoming a tenured professor.

To effectively assess the factors that contribute to women's research success, the Panel determined that the inquiry needed to begin with the factors present early in life which could affect a girl's or woman's decision to enter or remain in academia. As authors Xie and Shauman (2003) argue in *Women in Science*, the life course perspective, as opposed to the common "pipeline" approach, enables researchers to not only examine the multidimensional nature of human lives, but also to consider the effects of external influences. In addition to personal interests and skills, as well as the push and pull factors that are located along the career path, broader social, institutional, and economic contexts will also influence a research career. The Panel recognized that this wider, interdependent context would be beneficial to help readers grasp the full complexity of the influencing factors. These contexts are constantly at play to varying degrees throughout the life course. For example, the social context includes factors such as gender stereotypes and socialization; the institutional and political context includes government legislation (such as Employment Equity) and university policies (including hiring and promotion policies); and the economic context includes wages, grants, and funding. Each of these factors, along with the several others identified in this report, affect the career trajectories of women researchers.

This life course perspective provides a framework for the entire report, by addressing the factors that affect research trajectories from the early years, through elementary, junior and senior high school, the university experience, and in different career stages. Note that, while the source population at the pre-university level is large in Figure 1.4, the bars narrow as we look further down the life course. Arrows pointing away from the research career path symbolize the loss of potential candidates who change trajectories due to different factors encountered along the journey to becoming a tenured professor.

1.10 DIVERSITY OF RESEARCHERS

Feminist scholarship also informed the Panel's work. Research of this nature has proliferated since the 1970s, following the introduction of women's and gender studies courses and departments nationally and internationally. Feminist analyses offer many approaches but fundamental to most are recognition of standpoint, or one's perspective on the world based upon one's social location (Chapter 2) and diversity. Diversity is an essential component of a feminist, and indeed any comprehensive, analysis. To quote Canadian scholars Drakich and Stewart (2007), "To speak only of gender in the 21st century is an anachronism." It is not only women who have experienced historical discrimination. Other social markers of difference, such as indigeneity, ethnicity, age, ability, religion, gender identity, and sexual orientation are important considerations. Faced with these multiple and overlapping barriers to success, women from minority

backgrounds face what is known as the "double-bind" (Malcom *et al.*, 1976). Canada's changing demographics indicate that it will become increasingly important to consider the effects of policies and social conventions on other underrepresented groups for an inclusive society in which all Canadians have the tools to fulfil their potential. Diversity is one of Canada's strengths, and recognition of this principle, in policy and practice, will benefit the entire country. The Panel recognized that this report does not pay sufficient attention to the topic of diversity in all its forms. This is partially due to the nature of the charge that specifically indicated that gender should be the main variable in the analysis, as well as a lack of data on diversity among researchers (especially data on three of the four equity groups that have been for decades the target of the Federal Contractors Program, namely, Aboriginal peoples, people with disabilities, and racialized minorities).

In the U.K. and the U.S., equity data are gathered at the institutional level, facilitating equity performance comparisons between institutions that are not possible at this time in Canada (CAUT, 2007). In addition to gender and citizenship data provided in the UCASS, the only national equity data available on academic staff in Canada is collected through the census — which includes a limited number of equity variables (CAUT, 2007). As a result, the Panel had access to some data which enabled them to form a partial image of the representation of equity groups in postsecondary institutions. Readers are asked to bear in mind that these limited results should be interpreted with caution.

In 2006, racialized minorities[17] accounted for 16.2 per cent of Canadians (Statistics Canada, 2006a) and, based on self-reported data from students at 25 Canadian universities, 17 per cent of graduating undergraduate students (CUSC, 2006). From 1996-2006, the percentage of university teachers[18] who were also racialized minorities increased from 11.5 per cent to 14.9 per cent (CAUT, 2012[19]). In 2006, Aboriginal people[20] accounted for 3.8 per cent of the total population of Canada, (Statistics Canada, 2008b), 3.0 per cent of graduating undergraduate students (CUSC, 2006[21]), and 1.0 per cent of all university teachers (CAUT, 2009[22]). In 2006, persons

17 Government departments and agencies often collect data on "visible minorities" (as does the Canadian Census). While recognizing that the terms are not always synonymous, this assessment tends to use the term "racialized minorities" or "racialized groups" instead (see Backhouse *et al.*, 2011).

18 CAUT's classification of full professors, associate professors, assistant professors, and lecturers.

19 Based on 2001 and 2006 Statistics Canada data.

20 Including individuals who self-identified as an Aboriginal person, Metis, or Inuit (Statistics Canada, 2006f).

21 Based on self-reported data from undergraduate students at 25 Canadian universities.

22 Based on 2006 Statistics Canada data.

23 Disability rises with age, and teachers are older than students.

24 Based on 2001 Census data.

with disabilities accounted for 14.3 per cent of all Canadians (HRSDC, 2006) and 6.0 per cent of undergraduate students who were graduating (CUSC, 2006). In 2001, they represented 9.3 per cent of all university teachers[23] (Robbins & Ollivier, 2006[24]). In terms of Canada Research Chair holders, Picard-Aitken *et al.* (2010) note that "no ideal source of data" exists that would provide an accurate portrait of the proportion of these groups [racialized individuals, persons with disabilities, and Aboriginal people] among the population of potential chair holders." Based on the limited data available for 2007 and 2008, the authors were able to conclude that 15 per cent of Canada Research Chairs nominees were racialized minorities, which suggests that as a group, racialized minorities are not underrepresented in the program as a whole. That said, one third of large universities and one half of small universities reported a gap in their targets for this group. Insufficient data were available to draw conclusions about nominees who were Aboriginal people or persons with disabilities (Picard-Aitken *et al.*, 2010).

1.11 ILLUSTRATIVE PRACTICES

In response to several of the issues and challenges affecting the career trajectories of female academics, the Panel sought out illustrative practices from Canada and the international community. Initially, the Panel hoped to present best practices, but encountered methodological challenges that prevented this. The *Practising Gender Equality in Sciences* (*PRAGES*) report (Cacace, 2009), outlines a methodology to assess the quality of gender-based programs and policies, which includes the indicators of relevance, effectiveness, efficiency and sustainability.

Ideally, the Panel would have liked to use this rubric to assess all the practices identified, and present those meeting the criteria as best practices. However, considering several practices have been implemented relatively recently, it was particularly challenging to evaluate practices against the sustainability or effectiveness criteria. The Panel was also limited by the lack of technical information available about several practices, as well as constrained by time. As a result, the efficiency and effectiveness (or quality) of practices were difficult to evaluate. Given this, it was decided that while it was still important to identify relevant practices, these practices should be considered *illustrative*, as opposed to *best*. Thus, the policies and practices presented throughout this report were chosen by the Panel because they are examples of thoughtful solutions that were created to address clear challenges and policy gaps. Many are innovative, and several have been recognized by local and international communities with awards. The illustrative practices presented in text boxes throughout this document are not meant to be comprehensive, nor assumed to be effective in all jurisdictions. Instead, they represent responses to specific challenges identified by individuals and groups

who are working to improve the status of women in academia, and captured by the Panel to emphasize promising initiatives. See Appendix 4 for a detailed analysis of illustrative practices.

HOW THIS REPORT IS ORGANIZED

This report is divided into two sections. Part I provides a general overview of the topic of women in research careers. This includes the historical context, a discussion of women's research contributions, and quantitative data from both national and international perspectives that describe the current situation. Part II presents as detailed an analysis as possible of the specific factors that affect the career trajectories of women researchers. These include the determinants of opportunities for researcher careers, the university environment, the paid work-family life balance, and a comparison of the situation of women researchers in government and industry.

PART I – Historical and Current Landscapes

Chapter 1 introduces the history and contemporary situation of Canadian women in university research. In addition, this chapter describes the charge presented to the Panel, as well as the conceptual framework and methods used to address the central question.

Chapter 2 highlights women's research contributions and discusses the importance of a diverse research community.

Chapter 3 provides data on the statistical profile of women as university students and faculty. This chapter also compares key Canadian statistics with data from comparator countries in order to understand how Canada fares internationally.

PART II – Research Careers

Chapter 4 examines the push and pull factors that influence the educational decisions of girls and women in the secondary and post-secondary environments. The determinants of selection for women's research careers are discussed, including stereotypes, role models, and the Canadian education system.

Chapter 5 focuses on the factors that are present within the university environment and affect the career trajectories of women researchers in academia.

Chapter 6 discusses the paid work-family life balance, and explores the family-friendly policy options that may make it easier for all researchers, but especially women, to build successful careers and families.

Chapter 7 describes the situation of women researchers in government and industry, and discusses the role of government policies and legislation in the context of women and equity.

Conclusions

Chapter 8 answers the charge through a review of the findings and conclusions of the report.

2

Spotlight on Women's Research Contributions

- Women in the Labour Force
- The Changing Nature of Research and Innovation

2 Spotlight on Women's Research Contributions

Chapter Key Messages

- Contemporary economic and social challenges are multi-faceted, complex problems requiring collaborative innovation from a variety of fields.
- Emerging evidence indicates that increasing the pool of Canada's researchers by opening opportunities to women and other underrepresented groups can generate stronger research outcomes. A wider pool of excellence, including a wider range of perspectives, can contribute to research and development. Fairness and equal opportunity for women is essential in these endeavours.
- Based on their life experience, researchers can bring different perspectives to their work in some fields. When multiple perspectives are brought into research projects, doors can open to new ideas and inventions.

2.1 WOMEN IN THE LABOUR FORCE

A fundamental premise behind the charge to the Panel, and the perspective of the Panel Members, is that women and men must have equal opportunities to excel in research and attain the highest levels of research accomplishment. Equal opportunity, of course, does not necessarily result in equal outcomes. But large differences in outcomes can signal major inequalities in opportunity. Equality of opportunity is a widely held value in Canada, the importance of which is predicated on ethical and legal principles. Canada officially declared its support for the principles of gender equality via the UN *Convention on the Elimination of All Forms of Discrimination against Women* (UNGA, 1979), the *Canadian Charter of Rights and Freedoms* (1982), *and the Canadian Human Rights Act* (1985), sending a signal to Canadians that equality is an important component of our value system. Moreover, equality of opportunity contributes to a vibrant intellectual milieu for Canadian society and assists in the identification of the strengths and innovative capacity of Canada's economy.

Ethics and Justice

From a social perspective, a key reason for studying the relative absence of women in research careers is the overarching issue of gender inequality in the workforce, along with the contributing factor of sex segregation by discipline (Xie & Shauman, 2003). Occupational segregation has been identified as a leading

cause of the gender wage gap (Dey & Hill, 2007), meaning that the chance to build a research-based career is a matter of pay equity (Hill *et al.*, 2010). Xie and Shauman (2003) argue that, since scientific careers confer prestige, the underrepresentation of women in scientific research positions contributes to the lower social status of women. They make this point in the context of natural and physical science-based research, but the same could be said for research careers in general. The converse is that increasing the number of women researchers would cause a drop in occupational segregation, ultimately diminishing gender-based inequality in the overall labour force.

From an ethical standpoint, parallels can be made between the case for women in research and the case for women in public life in general. Since women represent about half the population, the corollary is that women should be present in equal proportions at decision-making levels (Tremblay, 2005). Correspondingly, the underrepresentation of women in university research careers is a form of gender inequality.

Economic Relevance

Skills that are necessary for supporting Canada in the knowledge economy are increasingly in demand. To be among the world's innovation leaders, we must create, among other things, a talent bank of researchers and institutions that recognize and contribute to top-quality research and development (R&D) (STIC, 2011). A 2007 Industry Canada strategic plan, *Mobilizing Science and Technology to Canada's Advantage*, stressed the importance that Organisation for Economic Co-operation and Development (OECD) countries place on securing talented workforces through actions such as increasing scientific literacy and quality of education, supporting the mobility of students and researchers, and attracting more women and other equity seeking groups into research fields. However, this was the only significant reference to women researchers in either of these recent national documents. In comparison, the Canadian Coalition of Women in Engineering, Science, Trades and Technology (CCWESTT) outlines several benefits of gender diversity within research-specific fields in their 2011 report, *Increasing Women in SETT: The Business Case* (Emerson, 2011), as does *Paying Heed to Canaries in the Coal Mine* (Calnan & Valiquette, 2010), commissioned by Engineers Canada. These include addressing skills shortages, access to a wider talent pool, increased innovation potential, stronger financial performance, greater market development, strong returns on human resource investments, and competing in the global talent race.

The need for women in research is not limited to the physical and natural sciences or engineering. Research in the social sciences and humanities is equally vital to national well-being. This significance was noted in a report commissioned by the Committee of Vice-Chancellors and Principals and the Higher Education Funding Council for England in 2000, which stated that "the social sciences have provided the basis for such public goods as national statistics, censuses, and large parts of the toolbox of the modern management of economies, all of which contribute in fundamental ways to the innovation process" (Salter *et al.*, 2000).

Countries across the globe are joining the race to become innovation leaders. Many are noting the links among productivity, competitiveness, and the gender gap, and the effects of these interactions on economies and societies (Löftström, 2009; Hausmann *et al.*, 2010; OECD, 2008). As society relies more heavily on the creativity of skilled researchers to find solutions for today's challenges, and to educate the minds that will solve them tomorrow, it is essential to pay attention to the circumstances of Canada's researchers — who they are, where they are, and where they are not.

Labour Quality

From an economic perspective, the underrepresentation of female researchers in academia raises many potential problems, not least the effects of a labour pool that operates at considerably less than full capacity. University of Alberta President Indira Samarasekera noted:

> "I think our society isn't balanced if we don't have the contribution of both genders, in addition to people of different ethnic origins and different racial backgrounds. We all know that diversity is a strength. That's what you see in nature. So why would we rob ourselves of ensuring that we have it?" (in Smith, 2011).

U.S. researchers Hong and Page (2004) found that diverse groups tend to outperform homogeneous groups, even when the homogeneous groups are composed of the most talented problem solvers. They attribute this to the notion that individuals in homogeneous groups often think in similar ways, whereas diverse groups approach problems from multiple perspectives (Hong & Page, 2004). Considering that varied groups are "invariably more creative, innovative and productive" than homogeneous groups, the argument for encouraging women to be active in decision-making groups is similar to that for minority populations in general (Calnan & Valiquette, 2010). Similarly, the European Commission's Expert Group on Structural Change (2011) analyzed a number of studies indicating that

group creativity is fed by gender balance,[25] and collective intelligence is positively correlated with the proportion of women in a group.[26] As the McKinsey (2008) Report *Women Matter 2* pointed out, since half of the talent pool is made up of women, it makes economic and social sense to bring the best minds of both sexes together to address the challenges that face society.

Some sectors are already dealing with skills shortages. In their 2008 report, the Information and Communications Technology Council estimates that Canadian employers will need to hire between 126,400 and 178,800 workers in the information and communications technologies from 2008–2015. However, domestic graduates are projected to meet only 49 to 70 per cent of current hiring requirements (ICTC, 2008). Growth in these research areas, emerging labour shortages, and attrition due to the retirement of baby boomers speak to the need for an integrated and inclusive workforce. A strong research community is important for improving the quality of life of Canadians, providing social and scientific innovation, creating well-compensated jobs in the knowledge economy, and enhancing Canada's voice and image globally (Industry Canada, 2007).

From a human resources perspective, labour mobility and a flexible labour force are important. However, there is also the incentive to mitigate employee attrition, to maintain consistency in client relationships, and to diminish the loss of corporate knowledge. The combined costs of vacant positions, new employee training, and investments in professional development make turnover a costly endeavour (McLean, 2003). This is important considering that evidence indicates that women tend to leave private sector organizations at higher rates than do their male colleagues (Hewlett *et al.*, 2008). For example, *The Athena Factor* (Hewlett *at al.*, 2008) states that over half (52 per cent) of women[27] leave their private sector jobs in science (47 per cent), engineering (39 per cent), and technology (56 per cent). Among women who quit their private sector science, engineering, and technology (SET) jobs, about half (48 per cent) relocate to a SET job outside of the private sector (self-employed, start-up companies, government, or non-profits), whereas the other half abandon their SET career paths to take on non-SET jobs, or take time out of the workforce. The authors found that extreme job pressures and hostile work environments were named more often than insufficient compensation as reasons for why women leave their private

25 See London Business School (2007). Innovative Potential: Men and Women in Teams.

26 See Woolley *et al.*, 2010. Evidence for a Collective Intelligence Factor in the Performance of Human Groups.

27 In this Harvard Business Review Research Report, data was gathered from 28 international focus groups, four surveys and several interviews. The women represented in this sample can be considered to be part of an international community of SET professionals.

sector SET jobs. The brain drain of "uniquely qualified and unusually committed women" (Hewlett *et al.*, 2008) who have dedicated large portions of their lives to their education is clearly a problem, and it strengthens the business case for keeping talented women in the research-based workforce.

2.2 THE CHANGING NATURE OF RESEARCH AND INNOVATION

New Knowledge and Perspectives

In the process of knowledge creation, it is important to consider how research is understood and prioritized. A standpoint is the perspective on the world resulting from a particular position within the structure of the social system (Harding, 1991; 2004 and Haraway, 1988). Research is influenced by the researcher's standpoint on the issues the researcher considers to be worth investigating, the questions the researcher asks, the data the researcher considers to be worth collecting, the conclusions the researcher draws, and the value the researcher places on any given piece of research. Variables such as gender, indigeneity, ethnicity, socio-economic status, and sexuality can affect knowledge perspectives. It is important to incorporate diverse bodies of knowledge into research problems in order to ask appropriate questions and uncover new answers. Coming from a broad range of disciplines and backgrounds, Panel Members had different perspectives regarding the extent to which gendered perspectives inform research priorities and outcomes, and whether or not this matters for all realms of scholarly endeavour. The Panel agreed that contributions from both men and women are important to reflect the impact that lived experience and acquired knowledge exert over research priorities, although this may be more apparent in some disciplines than others.

For example, women have made significant headway in many areas of the social sciences and humanities in the last 40 and more years. Nonsexist research methods have been promoted by Canadian scholars such as Margrit Eichler for decades (Eichler, 1987), and gender-based analysis (GBA)[28] has been used extensively in the social sciences for several years. In 1995, the Government of Canada committed to implement GBA in its departments and agencies (OAG, 2009), and the principle of

28 Gender-based analysis (GBA) is "a tool to assist in systematically integrating gender considerations into the policy, planning, and decision-making processes. It corresponds to a broader understanding of gender equality using various competencies and skills to involve both women and men in building society and preparing for the future" (SWC, 2007).

gender mainstreaming[29] has complemented this process (SWC, 2002)[30]. Canadians now understand the world as a more complicated place in which gender, as well as race, class, ability, and sexualities, matter. There are Canadian scholars who have recognized that domestic labour is in fact work (Eichler, 1987), that social security systems tend to privilege male breadwinner families (McKeen, 2004) and that women's work and knowledge is key to agriculture worldwide (Desmarais, 2004). In Canada, research shows that women form the majority of the poor and that many forms of gender-based violence still exist (PHAC, 2008). The list goes on. Research programs in other disciplines have a similar opportunity to grow their knowledge base by widening their talent pool. The Panel noted that society cannot know exactly how more diverse standpoints will change priorities and outcomes in research, but there is every reason to believe that change could occur (See Box 8.1, Misperception #4).

Gender and Innovation

The Panel noted that gender can be brought into the research process in two main ways. The first is that gender and sex can be included as variables to consider in research projects, and the second is that researchers themselves can bring gendered perspectives to scholarly endeavours in some fields.

General Motors was able to create a safer car using the perspective of a female design team, an inspiration that the company cited when it appealed to women, who are responsible for 50 per cent of vehicle purchases and influence 80 per cent of vehicle purchases (Orser, 2000). Features such as night vision technology, seat adjustments for pregnant women, and child safety latches were included. This is an example where gender, in terms of perspective and variables, was successfully integrated into the innovation process. Similarly, Canadian engineering professor Monique Frize (2009) cites the example of a female civil engineer who designed a new ferry terminal in New Brunswick in the 1980s. Based on her experience as a mother, she included diaper-changing tables in both the men's and women's washrooms — a design feature now generally adopted in airports and other

29 Gender mainstreaming is "a dual approach that implies the reorganization, improvement, development, and evaluation of all policy processes for the purpose of incorporating a gender equality perspective into all policies, at all levels, and at all stages, by the actors normally involved in policy-making. By bringing gender equality issues into the mainstream, we can make sure that the gender component is considered in the widest possible variety of sectors, such as work, taxation, transport, and immigration" (SWC, 2007).

30 Canada's Auditor General, however, noted that Canada lacks a government-wide policy to perform GBA, and the extent to which GBA frameworks are implemented varies across federal departments (OAG, 2009).

transportation terminals, and indeed in washrooms in malls, restaurants, and public buildings. Stemming from the perspective that child care is a shared responsibility, this female engineer was able to create a solution to a common challenge.

Box 2.1
Recognizing Gendered Knowledge: The Research Council of Norway (Norges forskningsråd)

"The Research Council views it as essential that gender perspectives are given adequate consideration in research projects where this is relevant. Good research must take into account biological and social differences between women and men, and the gender dimension should be one of the main pillars of the development of new knowledge. In research projects this dimension may be manifested through the research questions addressed, the theoretical approaches chosen, the methodology applied, and in the efforts to assess whether the research results will have different implications for women and men."

Excerpt from the Research Council of Norway's (2010) requirements for grant proposals for the Innovation Project for the Industrial Sector.

Conversely, when women are not part of the creative process, women's needs and wants, as well as those of society in general, may be overlooked (Hill *et al.*, 2010). In a broader context, the failure to consider gender in research projects represents a major obstacle to knowledge development, as outlined by the *Gendered Innovations* project (Schiebinger *et al.*, 2011). In terms of engaging with sex and gender as objects of scientific inquiry, early voice-recognition software was programmed to understand only male voices, and the first airbag systems were created to protect adult male bodies (Margolis & Fisher, 2002). Recognizing the need to ensure the safety of female passengers, Volvo designed the world's first virtual dummy of a pregnant woman. However, there is still no alternative to the standard 3-point seatbelt, despite the fact that they do not fit pregnant women properly (Schiebinger & Schraudner, 2011). In another example, the absence of gendered approaches during the development process of the pacemaker resulted in the initial development of technology that was too large to fit in women's chest cavities (UNESCO, 2007). These design examples from industry are illustrative of the broader social and economic benefits derived when women conduct research and when research addresses gender-specific issues.

Internationally, women's contributions to research are also essential in the field of sustainable development, as highlighted by the Millennium Development Goals. For instance, research advancements in science, environment, and health have the potential to increase agricultural productivity, reduce child mortality, and develop new treatments for HIV/AIDS. A gendered perspective observes that women in developing countries know about and are often responsible for food production, are predominantly responsible for the health of children, and are affected by HIV/AIDS at higher rates than men in Africa (UNESCO, 2007). Because of their social roles, women's and men's connections and experience with these issues can be very different. Consider also water procurement, a task that is often delegated to women and girls in developing countries (Hutton *et al.*, 2007). Participatory research and design methods that tap into local women's knowledge about water tables and locations are helpful to civil engineering projects (such as where to locate wells and taps) and can help to increase the school attendance of children (Schiebinger *et al.*, 2011). These gender-specific cases illustrate the necessity to include women's knowledge, perspectives, values, and research in the quest to solve some of the pressing issues of our time.

Box 2.2
Gender-specific Focus Drives Innovation

Around the world, countries are prioritizing the value of gender in the research process. For example, "the EU 2020 Strategy places high expectations on innovation, research and development in helping Europe to address the grand challenges [climate change, energy and resource efficiency, health and demographic change (European Commission, 2010)] and promote economic and social development. Extensive evidence is available to demonstrate that gender has multiple horizontal aspects with regard to these goals. Gender is an important dimension of innovative creativity and should be included in the innovation cycle." Canada may be able to learn from the process and results of this strategy.

Public Consultation on the Future of Gender and Innovation in Europe, Summary Report (genSET, 2011).

3

Representation of Women in the Academy

- Women as Faculty Members: Still Underrepresented
- Women's Career Pathways by Discipline
- Gender, Age, and Hiring
- Moving Through the Ranks
- Women's Representation and Type of University
- Canada Compared to Other Countries

3 Representation of Women in the Academy

Chapter Key Messages

- While there has been a great deal of positive change for women in post-secondary education since 1970, women's representation varies significantly by field. The highest representation of women as students and faculty is in humanities, social sciences, and education, and life sciences, and the lowest in physical sciences, computer science, engineering, and mathematics (PCEM). Though women form the majority of undergraduate and master's students, and are nearly at parity with men at the doctoral level, women represent just 21.7 per cent of full professors, 32.6 per cent of total faculty, and nearly half of all sessional instructors and lecturers. Despite the gains, there is a great distance to go to approach equity, especially in PCEM.
- The Canadian profile is generally similar to that found in other economically advanced nations including the U.S., and to the average profile across the EU — the higher the rank, the fewer women are present. However, there are some notable differences within ranks which indicate that some countries are performing better than others in terms of the representation of women in university research positions.
- Snapshot data from a single point in time indicate that the percentage of women is lower at each ascending rung of the career ladder, in comparison to men.
- On the other hand, synthetic cohort data suggest that the proportion of women in full professor positions generally reflects the proportion of PhD graduates 25 years earlier. While this finding is generally positive, there is still a slight decrease in the percentage of women between the ranks of associate and full professor. This decrease indicates that the passage of time alone will probably not be enough to reach parity.
- The near-invisibility of comprehensive data regarding women in the academy indicates that much remains to be done to address equity and diversity. In addition, key pieces of data are missing regarding the situation of female postdoctoral students.

Box 3.1
Accessing Data

In order to examine the Canadian context in different research fields and to attempt a life course analysis, the Panel requested data from Statistics Canada, principally from the Census, the University and Colleges Academic Staff System (UCASS), and the Postsecondary Student Information System (PSIS). Data on research grant recipiency were also requested from the Natural Sciences and Engineering Research Council of Canada (NSERC), the Social Sciences and Humanities Research Council (SSHRC), the Canadian Institutes of Health Research (CIHR), and the Canada Research Chairs program. However, due to the general absence of longitudinal data, it proved impossible to develop a direct and comparative statistical analysis of the life course, academic, and research trajectories of female and male Canadian researchers. In comparison to studies available for the physical sciences, mathematics, computer science, and engineering fields, there were relatively few studies of any kind dealing with the humanities, social sciences, or similar fields. The Panel also obtained published and unpublished data from the Association of Universities and Colleges of Canada (AUCC), the Canadian Association of University Teachers (CAUT), Engineers Canada, and the NSERC report on *Women in Science and Engineering in Canada*. Again, these data could not support direct analysis from a life course perspective. A further challenge was that these sources of data often employed slightly different definitions of a "university researcher" (see Appendix 1 for more details). As a result, some discrepancies may exist among datasets.

3.1 WOMEN AS FACULTY MEMBERS: STILL UNDERREPRESENTED

For the Panel's analyses, fields of study were organized into three large categories: humanities, social sciences, and education (HSE); life sciences (LS); and physical sciences, computer science, mathematics and engineering (PCEM).[31] The HSE, PCEM and LS categories are somewhat different from the categories commonly used in other reports, such as the well-known science, technology, engineering and mathematics classification (STEM);[32] however, the Panel decided that the

31 See Appendix 1 for more details on the large fields of studies used in the context of this analysis.

32 According to the U.S. National Center for Education Statistics (2011), there are different ways to define STEM fields. For example, the National Science Foundation (NSF) defines STEM fields broadly to the point that it includes psychology, political science, sociology and economics, whereas U.S. federal and state government STEM initiatives often include math, natural sciences, engineering, and technologies (NCES, 2011). In the context of this report, STEM would include PCEM and LS, but the Panel's groupings allow for further disaggregation of data.

former classification was best suited to the Canadian context. For example, HSE, LS, and PCEM reflect the priorities of the three major Canadian granting agencies (SSHRC, CIHR, and NSERC). Considering the Tri-Council's high level of involvement in funding available to researchers, it is logical to use a uniquely Canadian framework to define disciplines at the aggregate level.

Looking back to the academic year 1970–1971, women accounted for 7.0 per cent of all faculty, including only 3.0 per cent of full professors, 6.1 per cent of associate professors and 10.2 per cent of assistant professors (see Appendix 2, figure A2.1) (Statistics Canada, n.d.d.).[33] Many changes in the professoriate have occurred since then. In the academic year 2008–2009, women represented 11,058 of all 33,939 full-time faculty,[34] or 32.6 per cent (Table 3.1). However, their proportions are greatest in lower academic ranks, such as lecturers/instructors (45.7 per cent in 2008–09) (Statistics Canada, n.d.d.). Moving up the academic ladder, women composed 42.6 per cent of assistant professors, 36.2 per cent of associate professors, and 21.7 per cent of full professors, as depicted in Table 3.1 (Statistics Canada, n.d.d.).The higher the rank, the fewer women are present in comparison to men, despite increases in women's overall faculty representation.

Women are underrepresented in all three large fields (LS, HSE, PCEM). However, important disparities exist among fields. In the year 2008–2009, HSE had the highest percentage of women who were full professors (28.5 per cent), followed relatively closely by LS (23.4 per cent). PCEM had by far the lowest percentage of women in full professor positions, at 9.0 per cent. Again, in lower ranks, women are better represented. For example women accounted for 48.0 per cent of assistant professors in HSE, 46.1 per cent in LS, and 23.9 per cent in PCEM (Statistics Canada, n.d.d.).

It should be noted that 60 per cent of the 120 life science lecturers and instructors tallied and not ranked in Canada are female, as are over half of lecturers and instructors in HSE (51.1 per cent) (Statistics Canada, n.d.d.). This is notable because women comprise no more than 50 per cent of the population in other faculty positions.

33 As mentioned at the outset of this report, Statistics Canada data used in this assessment has either been: a) reproduced and distributed on an "as is" basis with the permission of Statistics Canada; or, b) adapted from Statistics Canada. This does not constitute an endorsement by Statistics Canada of this product.

34 Unless otherwise specified, faculty is defined as follows: full-time teaching staff who hold an earned doctorate degree and are employed in public or private degree-granting institutions. See Appendix 1, UCASS data for more information.

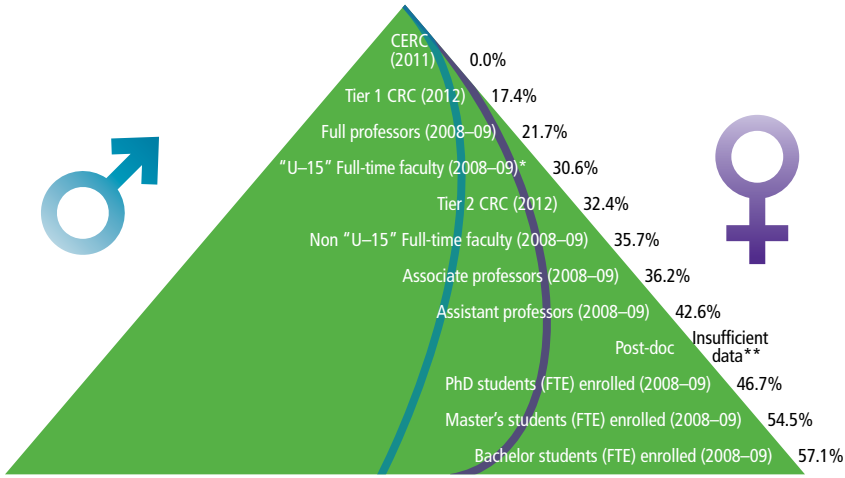
Table 3.1

Representation of Women among Academic Staff by Seniority and Field of Study in Canada, 2008–2009

	Percentage of women as full professor	Percentage of women as associate professor	Percentage of women as assistant professor	Percentage of women in lecturer/instructor position and other/not-ranked	All	Total number of researchers (women and men)
Life sciences	23.4	41.5	46.1	60.0	35.0	7,089
Humanities, social sciences and education	28.5	42.6	48.0	51.1	39.6	18,390
Physical sciences, computer science, engineering and mathematics	9.0	15.5	23.9	29.1	14.8	8,235
Other subjects or not reported	18.2	30.8	36.7	0.0	32.0	225
All subjects	21.7	36.2	42.6	44.9	32.6	33,939
Total number of researchers (women and men)	12,657	12,120	8,394	768	33,939	

(Data Source: Statistics Canada, n.d.d.)

Another way of looking at the data is illustrated in Figure 3.1. This pyramid represents a recent snapshot of the proportion of women in Canadian university research positions. Although women made up 57.1 per cent of bachelor's students and nearly half (46.7 per cent) of all PhD students, only 21.7 per cent of all full professors were women as of 2008–2009 (Statistics Canada, n.d.d., n.d.b.). The concept of the pyramid was inspired by a version published by Robbins & Schipper (2011). The blue line on the pyramid represents the proportion of women at the different levels of research positions at the end of 2010, approximately. The purple line represents the proportion of women in key research positions for the year 1980–1981.[35] It is important to emphasize that this figure seeks to show the pyramid effect of where women in academia are today, and does not account for recent trends by age. Women are generally better represented in younger cohorts, as will be discussed in Section 3.4 and 3.5.



(Data Source: Adapted with the permission of Wendy Robbins and Bill Schipper. Statistics Canada, n.d.d., n.d.b.; CRC, 2012b; CERC, 2012; CAUT, 2012)

Figure 3.1

Proportion of Women in Canadian University Research Positions

This pyramid presents a snapshot of the representation of women at different levels of a university career. The blue line on the pyramid is a rough representation of the proportion of women at the different levels of research positions at the end of 2010, approximately. The purple line estimates the proportion of women in key research positions for the year 1980–1981.

* U-15 is composed of the 15 leading Canadian Universities in Canada, see (CAUT, 2012) for more information.
** Please see section 3.1 and Table 8.1 for a discussion of post-doctoral student data.

35 The purple line is based on the data for the year 1980–1981: Undergraduate students enrolled (46.0 per cent), Master's students enrolled (40.0 per cent), PhD Students enrolled (29.9 per cent), Assistant professors (19.4 per cent), Associate professors (10.5 per cent), and Full professors (4.5 per cent) (Statistics Canada, n.d.d., n.d.e.).

Panel Members indicated that the transition between the doctoral and post-doctoral levels likely represents another point where women exit the research career trajectory towards becoming a university researcher, but little gender disaggregated data are available on Canadian postdoctoral fellows.[36] A 2009 survey conducted by the Canadian Association of Postdoctoral Scholars (CAPS) indicates that 44 per cent of the 1,192 post-doctoral respondents were female.[37] However, National Institutes of Health (NIH) data from the U.S. indicates that women are more likely than men to quit at points between post-doctoral and principal investigator positions (Martinez *et al.*, 2010). Martinez *et al.* found that the two major factors that lead to attrition of women researchers at this stage include family considerations and self-confidence issues.

3.2 WOMEN'S CAREER PATHWAYS BY DISCIPLINE

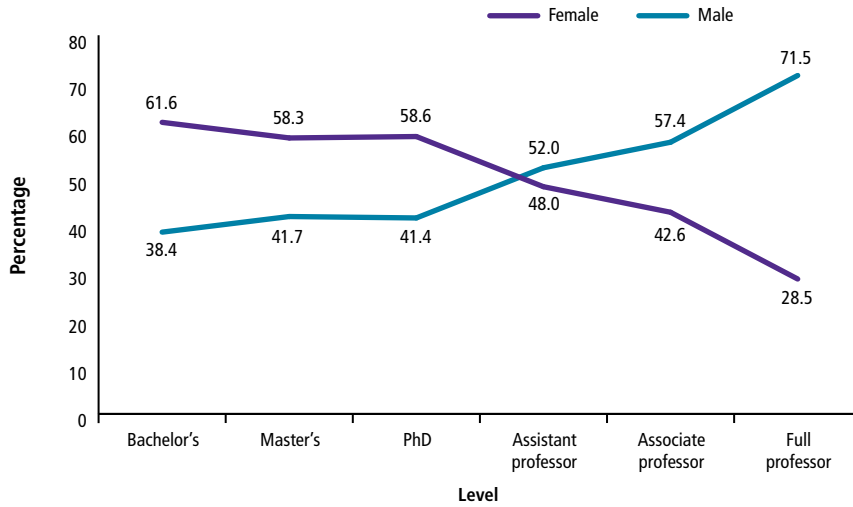
As first presented in Section 3.1, women's career pathways are also strongly influenced by field or discipline. In the absence of longitudinal data, the following three figures present cross-sectional (or single-point-in-time) data on women's current representation as faculty. Analyses over time begin with Figure 3.6, where the Panel used the data that were available to construct models that represent career trajectories. Because of the importance of longitudinal data in understanding patterns over time, the Panel hopes that these critical data will be collected in the future.

In the year 2008–2009, women made up 58.3 per cent of the students enrolled in HSE master's programs and 58.6 per cent of those enrolled in PhDs in these disciplines (Statistics Canada, n.d.b.). Out of all three large fields of study, HSE has the highest percentage of women at the PhD level. However, compared to undergraduate and graduate enrolment levels in HSE, the percentage of women is smaller at the level of assistant professor (48 per cent), associate professor (42.6 per cent) and, particularly, full professor (28.5 per cent) (Figure 3.2) (Statistics

36 Statistics Canada and AUCC publications were reviewed for gender disaggregated data on postdoctoral scholars. The Panel had access to post-doctoral application rates from the Tri-Council (please see Figure 5.4 and Appendix 3); however, Tri-Council resources are not the only source of funding for post-doctoral students. The Council requested data on postdoctoral fellows from each VP Academic and Provost from each university in Canada. The response rate to this request was too low to provide significant statistics.

37 For more information, please see http://sites.google.com/site/canadapostdoc/Home/survey/results.

Canada, n.d.d.). As a point of comparison, about 40 years ago (1970–1971), the proportion of women faculty in HSE was only 9.6 per cent. By 2008–2009, this proportion had increased to 39.6 per cent (please see Table 3.2 and Appendix A2.2).



(Data Source: Statistics Canada, n.d.d., n.d.b.)

Figure 3.2

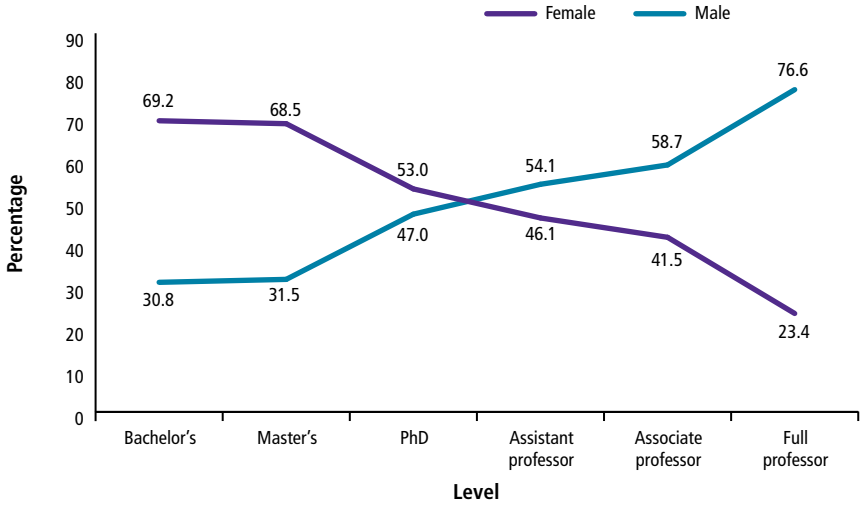
Percentage of Women and Men at Different Academic Levels in HSE

This figure displays the percentage of women and men in humanities, social sciences, and education in 2008–2009 at various stages of the academic career in Canadian universities.

Only instructional programs that lead to a PhD level program were mapped to a large field (HSE, PCEM, LS). See Appendix 1 for more details.

The situation differs slightly in LS. In the year 2008–2009, as with HSE, more women than men were enrolled as students. Women composed 69.2 per cent of the student population at the bachelor's level and 53.0 per cent at the PhD level (Statistics Canada, n.d.b.). The difference in the proportion of women at the PhD level (53.0 per cent) and the assistant professor level (46.1 per cent) is about seven percentage points; and from the level of assistant to associate professor (41.5 per cent), the difference is about five percentage points (Statistics Canada, n.d.d.). However, the difference is more pronounced at the full professor position, where women account only for 23.4 per cent of faculty (see Figure 3.3).

In 1970–1971, women accounted for only 9.1 per cent of full-time LS faculty (Statistics Canada, n.d.d.). By comparison, in 2008–2009, 35.0 per cent of LS faculty were women (please see Table 3.1 and Appendix A2.2).



(Data Source: Statistics Canada, n.d.d., n.d.b.)

Figure 3.3

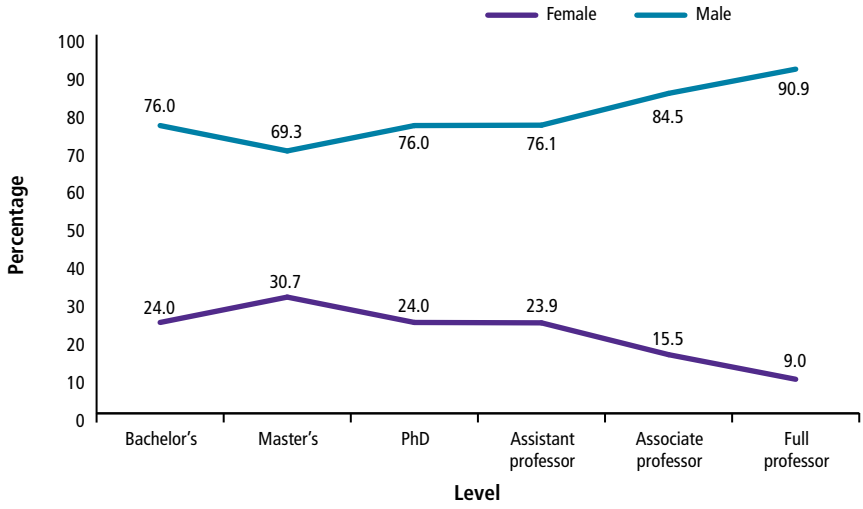
Percentage of Women and Men at Different Academic Levels in LS

This figure displays the percentage of women and men in life sciences in 2008–2009 at various stages of the academic career in Canadian universities.

Only instructional programs that lead to a PhD level program were mapped to a large field (HSE, PCEM, LS). See Appendix 1 for more details.

Finally, in PCEM, the pattern of women provides an interesting variant. While underrepresented through all levels of education (24.0 per cent at the bachelor's degree level, 30.7 per cent at the master's degree level, and 24.0 per cent at the PhD level), the proportion of women remains relatively stable from the PhD level to the assistant professor level (from 24.0 per cent to 23.9 per cent) (Statistics Canada, n.d.d., n.d.b.). However, the proportion of women is lower at higher ranks (15.5 per cent of PCEM associate professors are women and only 9.0 per cent of full professors are women) (Figure 3.4), although the difference is not as significant as in other fields, indicating that the relatively few women who

start out in this field generally remain and progress. While women's representation in PCEM is still very low today, bear in mind that the proportion of women among PCEM faculty grew from a mere 1.6 per cent in 1970–1971 to 14.8 per cent in 2008–2009 (see Appendix A2.2).



(Data Source: Statistics Canada, n.d.d., n.d.b.)

Figure 3.4

Percentage of Women and Men at Different Academic Levels in PCEM

This graph depicts the percentage of women and men in physical sciences, computer science, engineering, and mathematics (PCEM) in 2008–2009 at various stages of the academic career in Canadian universities.

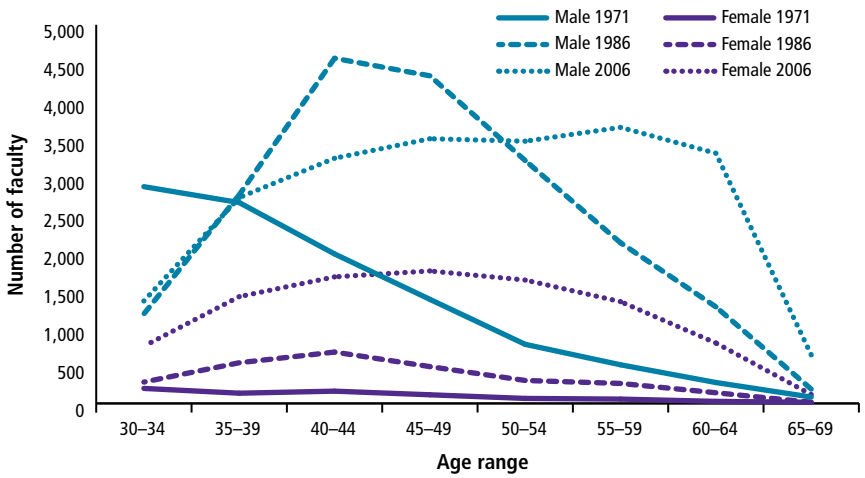
Only instructional programs that lead to a PhD level program were mapped to a large field (HSE, PCEM, LS). See Appendix 1 for more details.

The three fields of study (HSE, LS, and PCEM) presented in this report contain aggregated data which are composed of various disciplines. As described earlier, this level of aggregation roughly reflects the Canadian federal funding structure and is detailed enough to underlie major differences across fields. However, the Panel recognized that important disparities can occur within large fields, and these can be obscured at the aggregate level. For example, in 2009 in the large life science field, women accounted for 91.7 per cent of undergraduate students in nursing and only 56.8 per cent of students in genetics and heredity. In PCEM, 22.4 per cent of women were enrolled at the undergraduate level in civil engineering,

whereas 40.0 per cent of undergraduate environmental engineering students were women. Large disparities exist within HSE as well: women accounted for 39.9 per cent of students enrolled at the undergraduate level in economics, and 76.3 per cent in education (Statistics Canada, n.d.f.). While general trends among the three large fields of study create an important narrative, these disaggregated data are demonstrative of nuances within this larger story. This evidence can tell the reader more about where women are building specific inroads in research careers. See Table A2.1 in Appendix 2 for more details.

3.3 GENDER, AGE, AND HIRING

Another significant change in the university landscape is the age patterns of faculty. Figure 3.5 shows the number of faculty by age, sex, and calendar year. In 1971, there were very few female faculty members, while the number of the youngest men was about five times greater than the number of young women (Statistics Canada, n.d.d). This gender difference reflects a major hiring effort during the 1960s, accompanying the surge in student enrolment. However, hiring dropped substantially in the following years so that by 1986, the peak in the ages of male professors was in the 40–44 and 45–49 year age groups. Over this same period, the pattern for female faculty was quite different. By 1986, the number



(Data Source: Statistics Canada, n.d.d.)

Figure 3.5

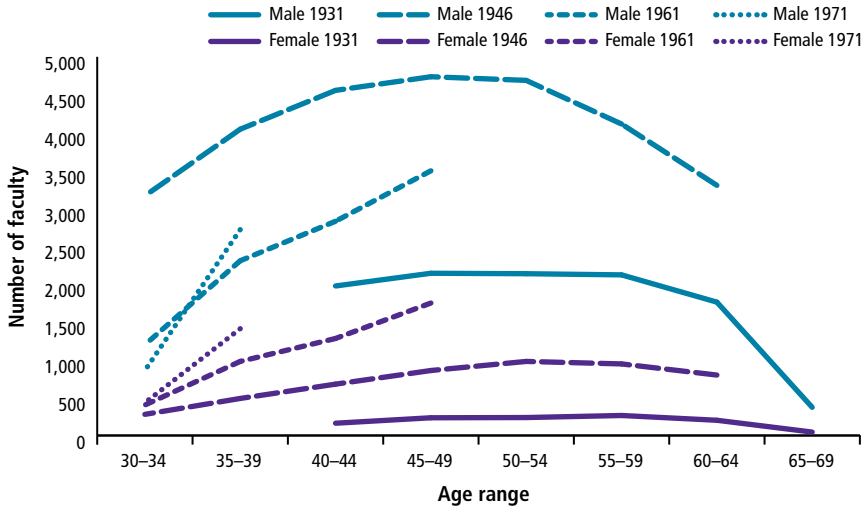
Distribution of Faculty by Age and Sex for Selected Years (Canadian Universities)

Years are provided for a given academic year. For example, 1971 corresponds to the academic year 1970–1971.

of female faculty more than tripled in each group above the age of 34. This represents significantly faster growth than that experienced by males, though from a much lower starting point. For example, for the age range of 40–44, the number of female faculty increased from 162 in 1971 to 678 in 1986. A peak in the 40–44 year age range is also apparent, though it is not nearly as pronounced.

By 2006, the trends for male and female professors had clearly diverged. The peak in 1986 numbers for those aged around 45 years levelled off for men, and moved up to the 55–59 age range. Numbers of male faculty aged 40–49 years declined substantially, remained about the same for those aged 30–39 years, and were considerably higher for those aged 55–64 years. In contrast, numbers of female professors increased substantially at all ages. Female faculty in 2006 were on average quite a bit younger than their male counterparts, with the highest numbers in the 40–54 year age range. However, in every age group, the number of women is close to half the number of men. These very different patterns for men and women over the past 40 years by age group indicate that the male-female mix of university faculty will likely continue to change throughout coming decades.

As mentioned in Section 3.2, another way to look at data on university professors is from the perspective of different generations or birth cohorts — by tracing the experiences of groups of men and women born in the same period. Because of the lack of longitudinal data, the Panel used this method to construct Figure 3.6, which shows the numbers of men and women faculty by age, according to when they were born. The data cover the period 1972 to 2008. As a result, the oldest cohort shown, those born around 1931, were in university just after World War II. They were in their early 40s in 1972 when the data start, so the curves for this 1931 cohort start only in the 40–44 year age range. Men in the 1931 birth cohort were much more likely to be employed as university professors, outnumbering their female counterparts almost 10 to 1. The 1946 baby boom birth cohort was much more likely to be employed as university professors than the 1931 birth cohort. For example, the numbers of women professors aged 45–59 years more than tripled from about 250 per five-year age group to between 850 and 950 (Statistics Canada, n.d.d.). The corresponding figures for male professors in this age range roughly doubled from about 2,000 per five-year age group to over 4,500.



(Data Source: Statistics Canada, n.d.d.)

Figure 3.6

Number of Female and Male Faculty According to Birth Year

This graph shows the numbers of female and male faculty in Canadian universities by age, according to when they were born.

As shown in Figure 3.6, those born in 1961, the number of male professors in the 30–34 to 40–44 year age ranges has roughly halved in comparison to the 1946 cohort. In contrast, the numbers of female professors in these age ranges has continued to increase between those two cohorts.

One notable feature of this graph is that the numbers of professors in the 1946 and 1961 birth cohorts increases until the 45–49 year age range. Moreover, this slope is steeper for the 1961 birth cohort, especially for women. There are several possible explanations. In the 30–34 year age range, it is likely that the average age at which students are completing their PhDs is increasing. In this age range, and the 35–39 year age range, there is an increasing period of post-doctoral work. And finally, PhD graduates may be more likely to work in other roles, which can significantly delay their entrance into the full-time professoriate.

3.4 MOVING THROUGH THE RANKS

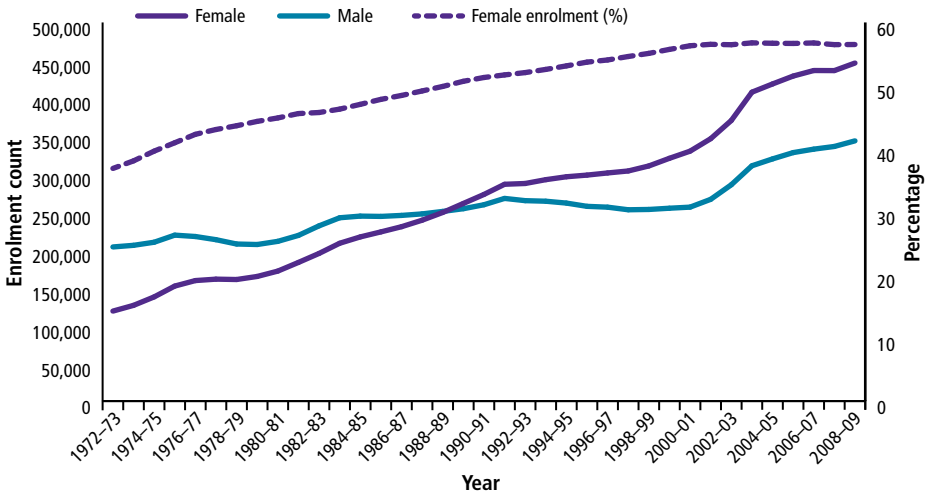
Box 3.2
Gender Inequity: How Leaky Pipelines, Glass Ceilings, Maternal Walls and Trapdoors Undermine Women's Performance in Research

For 30 years, the large numbers of women undergraduate students were expected to translate into increased numbers of women in top academic positions. Women would simply flow through the "pipeline" and expand the pool of qualified candidates for tenure track professors and academic administrators (White, 2005). Some talk of a leaky pipeline, in which women are lost at certain junctures, such as the point between earning a PhD and starting a university research career (Blickenstaff, 2005). Others, however, focus on different types of causes that undermine women's potential.

Joan Williams (2004) notes that many mothers encounter the "maternal wall," illustrated by the shortage of mothers in top faculty jobs (see Figure 3.1). In academia, this type of bias can be activated by pregnancy or maternal leave, and involves negative competence assumptions and "a distinctive maternal wall catch-22" (Williams, 2004). If women who are mothers behave in an assertive manner, they may be perceived as "difficult or uncollegial," yet if they play the "warm and nurturing role," they may end up with a disproportionate amount of professional service work (Williams, 2004).

In *Mothers on the Fast Track*, Mary Ann Mason and her daughter Eve Mason Ekman (2007) highlight the perils of glass ceilings and trapdoors for women in academia. They argue that after women make it into the academy, they encounter a "second glass ceiling" that represents a barrier to reaching the highest levels of their professions (Figure 3.1). They also discuss the paths that lead women to "second tier" academic jobs, such as non-tenure track and part-time positions (see also Figure 5.1 in Chapter 5). Some authors conceptualize these multiple obstacles that sideline women's research careers as part of a "labyrinth" that requires "persistence, awareness of one's progress, and a careful analysis of the puzzles that lie ahead" (Eagly & Carli, 2007).

As described in Chapter 1, the representation of women in higher education has changed dramatically over the past 40 years. In 1972–1973, only 37 per cent of full-time university students in Canada were female (Statistics Canada, n.d.e.). Gender parity by enrolment was achieved in 1989. By 2008, the majority of the university undergraduate and graduate student population (all fields, all programs) were women (56.5 per cent) and 59.6 per cent of degrees were granted to women (Statistics Canada, n.d.e., n.d.b.) (Figure 3.7).



(Data Source: Statistics Canada, n.d.e., n.d.b.)

Figure 3.7

Full-time University Enrolment of Women and Men in Canada, from 1972 to 2008

This figure shows the raw counts of female and male students, as well as the percentage of women enrolled.

The proportion of women among the general student population has been increasing. It is valuable, however, to note nuances by discipline. For example, female enrolment in undergraduate engineering programs reached a peak of 20.6 per cent in 2001, but dropped and stabilized around the 17 to 18 per cent mark for most of the decade. However, this trend may change given that in 2009 and 2010, the growth of female enrolment surpassed the growth of male enrolment in engineering programs — a pattern that has not been observed since 2001 (Engineers Canada, 2011). Looking more closely at the data, the Panel noted that in 2010, female undergraduate enrolment also varied by the type of engineering program, with their highest representation in environmental (39.7 per cent), biosystems (38.9 per cent), and geological engineering (36.9 per cent), whereas the lowest proportions were in software engineering (9.7 per cent), computer engineering (10.3 per cent), and mechanical engineering (10.4 per cent) (Engineers Canada, 2011).

The Panel recognizes that time is needed to see whether the higher numbers of women in the student population will translate into correspondingly higher numbers in tenure track or tenured positions. However, the Panel also questioned whether those changes would occur as quickly as one could expect considering the growth of female students among the general student population.

Published by CAUT (2011), new appointment data on full-time university teachers[38] from Statistics Canada and UCASS indicate that of the 2,361 new appointments in 2008–2009, 57.7 per cent were men, and 42.3 per cent were women. While this represents an increase from 2001–2002, when 62.7 per cent of the 2,634 new appointees were men and 37.3 per cent were women (CAUT, 2005), parity in new hires has not yet been achieved.[39]

Given the lack of longitudinal data available for a representative sample of men and women faculty, the Panel used an indirect approach to infer female faculty career paths. This is a similar approach to the data presented earlier in Figure 3.6. The Panel used complete data on the total number of full-time faculty, broken down by 10 year age group, sex, and stage in their university career every five years from 1971 (i.e., repeated cross-sectional data). These data allow for an assessment of the representation of women at different steps of the university career — from PhD to full professorship.[40]

These synthetic cohort data are presented in Table 3.2 (Statistics Canada, n.d.b., n.d.d., n.d.e.). The purpose of this table is to explore whether greater proportions of women than men leave academia at each rung on the career ladder, or take longer to move from one rung of the ladder to the next one by looking at the proportion of women[41] at increasingly higher career levels. For example, if the percentage of women decreases between two steps, we can assume that proportionally more men than women continued to move to the next stage.

Three "complete" career paths are indicated in Table 3.2 by the black, blue and green highlighted percentages of women, reading diagonally down and to the right, emphasized by the rectangular box. These highlighted paths that start are approximate, since they assume researchers earn their PhD between the ages of 25 and 35, attain an assistant professor position five years later (between the ages of 30 and 39), become an associate professor 10 years after that (between the ages of 40 to 49) and finally, reach full professorship in 10 more years (between the ages of 50 and 59).[42]

38 CAUT's classification of full professors, associate professors, assistant professors, and lecturers.

39 Please note that these data were not disaggregated by rank. New appointments by rank would be highly informative.

40 Please see Appendix 1 for further description of the methodology.

41 The proportion of men is not presented as it can be inferred from the proportion of women. For example, if the proportion of women is 40 per cent, the proportion of men would be 60 per cent.

42 The Panel used the number of faculty from 30 to 39 years old, broken down by gender, for the years 1971 to 2006 (in five year increments).

Table 3.2

Moving Through the Ranks: A University Cohort Analysis

This table shows the estimates of the proportion of women with earned PhDs, at the level of assistant professor, associate professor and full professor. The proportions are broken down by age range and selected years. Three "complete" and "standard" career paths are indicated in the table by the black, blue and green highlighted percentages of women, reading diagonally down and to the right, emphasized by the red rectangular box. In reality, career paths differ according to the circumstances of individual researchers. With this in mind, all data are presented to enable readers to chart alternative career paths (that account for time off or a longer period of time spent in one position, for example). For faculty data, dates are provided for a given academic year. For example, 1981 corresponds to the academic year 1980–1981. Considering that these data have been constructed from several data sets (as opposed to a true cohort analysis which would follow the same population of researchers over time) readers are asked to bear in mind that these proportions are estimates and to interpet the results with caution.

Year of earned PhD	Earned PhD (% female)	Assistant professor (% female)			Associate professor (% female)				Full professor (% female)			
Age range		30–39	35–44	40–49	35–44	40–49	45–54	50–59	40–49	45–54	50–59	55–64
1971	**9.3***	8.9	11.6	23.5	5.1	8.8	11.6	18.9	2.1	2.7	3.6	4.6
1976	**18.8**	**11.0**	14.3	21.5	6.5	9.0	13.7	16.3	3.4	4.3	5.0	6.2
1981	**24.2**	**17.8**	19.2	23.1	9.0	9.8	12.0	17.2	3.2	4.5	5.6	6.1
1986	27.5	**21.4**	24.9	32.4	14.0	**13.1**	12.3	14.2	5.5	5.2	5.9	7.2
1991	31.6	27.4	30.1	37.6	20.0	**19.3**	17.5	15.4	8.5	7.7	6.5	6.2
1996	34.0	34.2	36.7	42.0	26.2	**27.9**	27.4	22.8	13.9	11.8	**9.9**	8.3
2001	42.7	34.7	36.9	41.8	31.4	33.8	35.3	32.7	17.7	17.8	**15.1**	12.1
2006	43.3	36.6	38.0	41.4	32.0	35.6	38.4	38.8	21.7	22.4	**21.0**	17.5

(Data Source: Statistics Canada, n.d.b; n.d.d; n.d.e)

*Earned PhD data were not available for the year 1971. As a result, earned PhD data presented for the year 1971 correspond to the year 1972.

Reading down the first column of the table, the data show that the proportion of women among PhD graduates increased substantially from 9.3 per cent in 1971 to 42.7 per cent in 2001 (Statistics Canada n.d.b., n.d.d., n.d.e.). For the same cohorts, the proportion of female university faculty in the 30–39 year age range increased virtually in parallel, from 11.0 per cent in 1976 to 36.6 per cent in 2006. On the one hand, Table 3.2 clearly shows that women have been seriously underrepresented among the university professoriate, and they remain underrepresented. On the other hand, the situation is certainly improving — at a rate roughly in line with the growth in the proportion of women in the source population, namely, PhD graduates.

For example, in 1976, 18.8 per cent of PhD earners were women. Five years later, in 1981, women represented 17.8 per cent of assistant professors between the ages of 30–39 (Statistics Canada, n.d.d.). We observe a one percentage point drop in the proportion of women who ascended to this career rung. Between the level of assistant and associate professor, the proportion of women appears to increase slightly (from 17.8 per cent to 19.3 per cent). While this result might seem paradoxical, it could easily be explained by men moving to associate professor more slowly, or moving from associate to full professor more quickly — though these aspects can only be addressed with truly longitudinal data on university career paths.

The drop in the proportion of women appears more substantial between the level of associate professor (19.3 per cent) to full professor (15.1 per cent). As demonstrated in Table 3.2, these declines on the order of three to seven percentage points are seen in the adjacent five year age cohorts. The general pattern is that there is a small drop in the percentage of women in academia between attaining a PhD and an assistant professorship, a slight increase in their representation at the level of associate professor, and then a more significant decrease moving to the level of full professor. These results indicate that despite very strong progress at earlier career stages for women, some important barriers remain, suggesting a glass ceiling in the highest levels of academia.

Further, these data indicate that time alone will probably not be enough to balance the proportion of women and men at the highest levels of academia (see Box 8.1, Misperception #2). Following the trends presented in Table 3.2, and given the proportion of women among PhD graduates in 2008 (44.2 per cent, not listed in the table), the proportion of women at the level of full professor will likely increase significantly — but may still be 10 points below parity in 2035. Moreover, as opposed to the trends observed in earlier decades, the growth rate of women

in the "source population," namely PhD graduates, is slowing down. From 2001 to 2006, there was virtually no change. Finally, in recent years, the growth of the proportion of women among assistant professors has been slowing down. From 1996 to 2001, the percentage of women PhD graduates increased by about nine percentage points. Five years later, from 2001 to 2006, the proportion of women among assistant professors (from 30–39) increased by only two percentage points. Although those data points are too incomplete to present a trend, they may indicate a slowing down of the progress.

In conclusion, for the 1971, 1976, and 1981 cohorts of new PhDs, recent proportions of women in assistant and associate professor positions generally reflect the proportions of PhD graduates 25 years earlier. However, these same data, when the focus is on the transition from associate to full professor, show a decrease in the proportion of women in full professor positions. The passage of time alone will probably not be enough to reach parity.

Table 3.2 shows an overall picture; the equivalent data broken down by the three broad fields of studies are presented in Appendix A2.4 (Tables A2.2, A2.3 and A2.4). There are some differences among fields; however, the main messages remain true for HSE, LS and PCEM.

3.5 WOMEN'S REPRESENTATION AND TYPE OF UNIVERSITY

The representation of female faculty members varies across universities, generally and specifically by the type of university. Overall, the proportion of women among the professoriate[43] varies from 10.1 per cent to 61.7 per cent (Statistics Canada, n.d.b.). A substantial proportion of this variation relates to the fields of studies that are more common in the various universities. The Panel divided all Canadian universities with over 50 faculty into four broad groupings: undergraduate only; those with graduate student enrolment but no medical school; those with medical schools; and those with a large engineering program. For each of these four groupings, Table A2.5 in Appendix 2 shows Canadian universities ranked by the percentage of female faculty.[44]

43 Only degree granting institutions with more than 50 faculty were considered. In this list all faculty (with and without PhDs) are taken into account as well as all ranks (full professors, associate professors, assistant professors, other rank).

44 The full list is available Table A2.5, Appendix 2.

These variations across universities suggest that one of the most important factors driving the overall proportion of women among the professoriate is the mix of fields taught in those schools. Within the first two groupings (schools with graduate programs and undergraduate-only schools), the variation is about 10 percentage points. However, the variation in graduate schools with no medical school programs (GradNoMed) is over 40 percentage points. This large variation can mostly be explained by the various types of institutions in the GradNoMed category. Only two universities in Canada specialize in engineering (École Polytechnique de Montréal and École de technologie supérieure). These two degree-granting institutions have the lowest representation of female faculty of all Canadian universities. It is unclear if the proportion of women varies systematically across different types of universities. However, the range within each grouping is sufficiently wide to illustrate that there is scope for substantial improvements in the representation of women even if the mix of fields of study is not that different.

3.6 CANADA COMPARED TO OTHER COUNTRIES

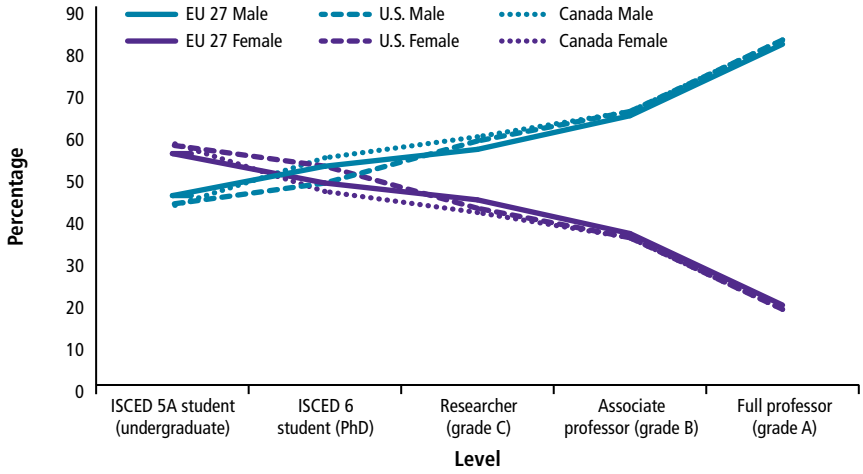
The higher one looks in university ranks, the fewer women are present in comparison to men. This trend is not unique to Canada. In general, the Canadian profile is similar to that found in other economically advanced nations including the U.S., and to the average profile seen in European Union (EU) countries. For example, in both Canada and the EU, women held slightly over 40 per cent of grade C[45] research positions and about 18 per cent of grade A[46] positions (Figure 3.8) in 2007 (Cacace, 2009).[47] This global similarity reinforces the systemic nature of the under representation of women in academia.

45 Grade C corresponds approximately to assistant professor classification.

46 Grade A is the single highest post at which research is normally conducted.

47 The data for researchers (A, B, and C Grade) was taken from the PRAGES report which was sourced from the European Commission, 2009, and Canadian Association of University Teachers, 2007, while the student enrolment data was taken from Education Statistics & Training (Eurostat database) with the Canadian data being supplied from Statistics Canada. The definition of the rankings is as follows (as adopted from p73 of the European Commission's 2009 publication, *She Figures*) and used in the classification of data from UNESCO/OECD/Eurostat data collection:

- A-The single highest grade/post at which research is normally conducted.
- B-Researcher working in positions not as senior as top position (A) but more senior than newly qualified PhD holders.
- C-The first grade/post into which a newly qualified PhD graduate would normally be recruited.
- ISCED 5A-Tertiary programs to provide sufficient qualifications to enter into advanced research programs and professions with high skills requirements.
- ISCED 6-Tertiary programs that lead to an advanced research qualification (PhD).



(Data Source: European Commission, 2009); Statistics Canada n.d.b.; Cacace, 2009)

Figure 3.8

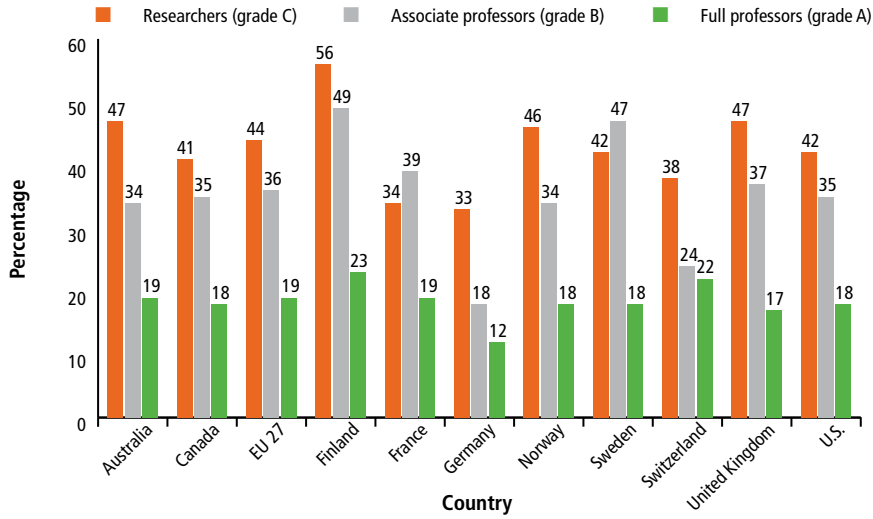
Canada Compared to the EU and U.S.: Similar Profiles

This figure depicts the proportion of female and male students and academic staff in a typical academic career in Canada, the U.S. and the EU, 2007.

A closer look at how female researchers are distributed at the different levels in Canada reveals again that, generally, women are underrepresented at the highest levels of academic scholarship (Figure 3.9). While women are present in similar proportions to men at the researcher level (Grade C), there are fewer women at the associate professor level (Grade B) and women's numbers are even fewer at the full professor level (Grade A). This gendered pattern of distribution between the ranks of researcher, associate professor and full professor is apparent in the majority of the countries presented in Figure 3.9.

While this Canadian trend is mostly similar to patterns found in many other advanced economies around the world, there is variation within ranks that is worth noting (Figure 3.9, Cacace, 2009). At 41 per cent, Canada has a lower percentage of women at Grade C (the researcher level) than Australia (47 per cent), the EU-27 average (44 per cent), and the U.S. (42 per cent). Some individual EU member states have a much higher percentage of women at this rank than Canada (e.g., Finland, at 56 per cent), while others have a lower percentage (e.g., Germany, at 33 per cent).

The percentage of women at the Grade B level is generally lower than at the Grade C level, with the exception of Sweden (47 per cent) (please see also Figures A2.3 and A2.4 in Appendix 2). Finland also boasts a comparatively higher percentage of women at this rank, at 49 per cent. However, the greatest difference in women's representation is noticeable between the ranks of associate professor and full professor. Again, there is some variation across countries (e.g., Finland at 23 per cent; Canada at 18 per cent; Germany at 12 per cent), which indicates that some nations have farther to go to achieve gender parity in research than others. In general though, the relatively low proportion of women at the full professor level suggests that the glass ceiling remains intact in Canada as well as in several comparator countries.



(Data Source: Cacace, 2009)

Figure 3.9

Canada Compared to Other Countries: Women Researchers at Different Ranks

This graph shows women's participation among researchers, associate and full professors in selected countries, 2007 (per cent).

It is also informative to look more closely at women's representation within a single discipline. The 2010 NSERC report, *Women in Science and Engineering*, repeats the findings of the U.S. National Science Foundation, which indicate a pattern of PhD production in the natural sciences and engineering (NSE)[48] that

48 Includes the life sciences, engineering and computer sciences, and mathematics and physical sciences (NSERC, 2010).

is "considerably lower" for women than for males, across 30 countries surveyed. Canada ranks 28th out of 30 countries for PhD production among women in NSE, and 22nd for men. For example, Canada at the student level produces a proportionately smaller percentage of female NSE doctoral degree earners than top-ranked Portugal, Sweden, Finland, Switzerland and the U.K., in addition to New Zealand, the United States, Estonia, Croatia, and Iceland, among others (NSERC, 2010). The report's authors conclude that "Canada's performance is equally dismal for both sexes, lagging far behind the leading countries in NSE PhD production" (NSERC, 2010).

Finally, the representation of women among university presidents is also revealing. Early analyses from Turpin (2012) found that the percentage of women university presidents in Canada increased in the late 1980s, climbed to around the 19 per cent mark by 1998, and has held relatively constant at this level since then. The Canadian situation is similar but slightly worse than the pattern in the U.S. In the American context, there was strong growth in the representation of women university and college presidents from 1986 (9.5 per cent) to 1998 (19.3 per cent), and then a slowing down by 2006 (23.0 per cent). As an extension of the trend where women faculty members are better represented at public than private institutions in the United States (CAUT, 2006b), more women were presidents of public institutions (26.6 per cent) than private institutions (18.7 per cent) in 2006 (ACE, 2007), indicating a progression of the trend at the faculty level in general. In addition, 13.5 per cent of university and college presidents in the U.S. in 2006 were racialized minorities, compared to 11.3 per cent in 1998, and 8.1 per cent in 1986 (ACE, 2007).

Part II

Research Careers

4

Determinants of Selection for Research Careers

- Biological Differences
- Gender Stereotypes
- Schools, Socialization, and Curricula
- The Post-Secondary Education System
- Mentorship

4 Determinants of Selection for Research Careers

Chapter Key Messages

- The issue of innate differences in ability is controversial, but the Panel found that sociocultural factors have a stronger influence on the academic performance of girls and boys. The Panel concluded that biological differences between women and men are not great enough to account for the low representation of tenured women professors in Canada.
- Gender stereotypes begin early in life. These stereotypes continue to operate in Canadian society, and can lead to prejudice. The lack of women in science and engineering — and the lack of men in education studies and humanities — could be a result of gender bias during childhood and teen socialization. Gender awareness in teaching may help to enhance learning for both girls and boys, and ultimately help to narrow the gender gap.
- Contrary to a widespread misperception, young women in recent years are generally not streamed out of science and mathematics courses in Canadian high schools. Although female and male students enrol in math and science courses in relatively similar proportions, there appears to be a disconnect between the decisions some students make at the secondary level and their post-secondary goals. This may be related to poor student understanding of what these careers entail, as well as a lack of female role models in certain fields. Illustrative practices include those that empower girls and boys to build awareness and interest in science before or during secondary school.
- As students, women outnumber men at the undergraduate and master's levels. Women are very close to parity with men as PhD students.
- The culture of physical sciences, computer science, engineering, and mathematics deters some female students from further study in these disciplines. Mentorship is an important strategy to address some of these challenges and to provide girls and women with opportunities to see other women engaged in research and also build career and social connections.

4.1 BIOLOGICAL DIFFERENCES

Innate sex differences in terms of hormonal influences on cognitive performance (Finegan *et al.*, 1992), genetic considerations and evolutionary adaptations (Eals & Silverman, 1994), including the greater male variability hypothesis,[49] as well as the relevance of brain structure (Halpern, 2000) have been recognized as possible factors contributing to the low representation of women in certain research positions. However, many of these findings are inconsistent across countries and provide limited results to support the idea that the paucity of women researchers in math, engineering, and science fields is a direct result of biological differences (Else-Quest *et al.*, 2010; Ceci *et al.*, 2009). Contrary to arguments that point to sex-based differences in ability, diminishing gender gaps in standardized test scores indicate that men and women are equally capable of succeeding academically when given the opportunity (see the OECD's *Programme for International Student Assessment Survey* (2010), for Canadian and international results. As the OECD concluded:

> "The wide variation in gender gaps among countries suggests that the current differences are not the inevitable outcomes of education and that effective policies and practices can overcome what were long taken to be the fixed outcomes of differences in interests, learning styles and even underlying capacities between males and females" (OECD, 2004).

The gender stratification hypothesis illustrates this point. It is based on the idea that international differences in levels of math achievement among girls and boys are reflective of gender inequities at the national level, such as gender equity in school enrolment, women's participation in research positions, and the percentage of women in politics (Else-Quest *et al.*, 2010). In terms of math achievement, meta-analyses from the American research team Else-Quest *et al.* (2010) found that girls and boys will demonstrate similar levels of success when they are encouraged to fulfill their potential, are provided with the correct educational tools, and can see female role models performing math. In their international study of gender equity and math performance, data from

49 This hypothesis, which was initially documented in 1984 by Havelock Ellis, is based on the idea that males exhibit greater variance in physical and mental traits than do females. Research in the following decades focused more on variances in measures of mental abilities (see explanation in Shields, 1982). Hyde and Mertz (2009) describe how this hypothesis has been used to promote the idea that males exhibit greater variance in test scores than do females. Even if there is no average gender difference, the idea is that there will be more males among the top performers because of this wider variance. However, considerable international variation in the female:male ratio of top performers indicates that sociocultural factors, such as the overall status of women and men in different societies, may play a larger role than biology (Hyde & Mertz, 2009; Penner, 2008).

Kane and Mertz (2012) found similar results: boys and girls tend to do better in math in countries that demonstrate greater gender equality. In addition, the U.S. research team Hyde and Mertz (2009) discovered that girls and boys have reached parity in mathematics performance in the U.S., as well as in some other countries. They refute the greater male variability hypothesis with their findings that the gender gap among the mathematically gifted[50] is diminishing in the U.S., and does not exist in some countries. Their research also revealed that women with "profound mathematical talent" (at the one in a million level) certainly do exist, leading to the authors' conclusion that gender differences in math performance are "largely an artifact of changeable sociocultural factors, not immutable, innate biological differences between the sexes" (Hyde & Mertz, 2009).

In light of this evidence, as well as research from Rivers and Barnett (2011) and the NAS (2007), the Panel concluded that biological differences cannot be enough to account for the low representation of tenured women professors in Canada, or their substantially lower numbers in comparison to men in the highly prestigious Canada Research Chairs and CERC positions (see Box 8.1, Misperception #1). Considering this, Panelists concentrated part of their assessment on the sociocultural influences that may set the stage for the career trajectories of women researchers.

4.2 GENDER STEREOTYPES

Social schemas and stereotypes affect the way people evaluate others. Because individuals must make several judgments and decisions daily, many choices are made with little deliberation. Schemas are mental shortcuts that help us to process information and make these decisions quickly (Hewstone *et al.*, 2005). Social schemas can be divided into several categories, one of which is role schemas (Fiske & Taylor, 1991). Role schemas include norms about specific roles in society, including achieved roles, such as occupation, and ascribed roles, such as gender, age, and race (Hewstone *et al.*, 2005). These schemas, which are resistant to change, represent some of the main physical cues that individuals use to cognitively categorize others.

Stereotypes build upon schemas. They are widely shared social and cultural expectations about how members of groups should behave. These expectations are learned, and determined by dominant representations (Hewstone *et al.*, 2005). Gender stereotypes, for example, are based on the outdated model of "separate

50 Considered to be those who score above the 95th to 99th percentile on achievement tests such as the Program for International Student Assessment (PISA) or Trends in International Mathematics and Science Study (TIMSS). There are two to four-fold more mathematically gifted males than females in these high percentiles, but these gaps have been closing over time (Hyde & Mertz, 2009).

spheres," where men were assigned to the public and intellectual sphere, while women were located in the private and emotional sphere (Elshtain, 1993). These stereotypes, sex roles, and social sanctions (Eichler, 1980) continue to operate in Canadian society, and can lead to prejudice. In the context of women in positions of leadership, prejudice "follows from the incongruity that many people perceive between the characteristics of women and the requirements of leader roles" (Eagly & Karau, 2002).

The effects of stereotypes are cumulative. The desire for peer acceptance plus the influence of stereotypes make it difficult for anyone to escape powerful "cultural messages" (Etzkowitz *et al.*, 2000). This is one of the reasons why gendered trends emerge in girls' and boys' choices and, combined with the lack of policy change, a reason why it is still difficult for women to advance in some university departments. Later on in the life course, these messages can make it harder for women's professional experience to be valued in academia, as evidenced by findings that demonstrate that *curricula vitae* are evaluated differently based on whether the applicant's name is male or female (Steinpreis *et al.*, 1999), or that blind auditions increase the chances that women musicians will be hired in orchestras (Box 4.1).

Box 4.1
Stereotypes and Blind Auditions for Orchestras

A common example of stereotype activation is that of blind auditions for orchestras (Goldin & Rouse, 2000). Women have traditionally been underrepresented in major symphony orchestras on the grounds that men are better musicians and that the sound quality decreases as the number of women in an orchestra increases (see Seltzer, 1989). Blind auditions, during which the musician plays while hidden behind a screen, were introduced in a number of major U.S. symphony orchestras in the 1970s. The authors of the study found that blind auditions increased the chances that a woman would advance from initial auditions by about 50 per cent, and her likelihood of being hired increased several-fold. Regardless of the quality of performance, gender stereotypes proved to be detrimental to women candidates.

Stereotypes exist throughout the life course, beginning early on and developing through time such that even women at the apex of their careers, such as the Canadian researchers involved with the Canada Research Chairs program, indicate that they experience problems of not fitting the stereotype of a top

researcher and not being taken seriously as a woman in a position of authority (see Appendix 5). Because of a perceived lack of knowledge regarding some of the challenges that women in science in particular face, programs such as Valian's (2006) *Tutorials for Change* aim to provide information on gender schemas, sex disparities in rank and salary, and best practices for making change to students, educators, and researchers.

4.3 SCHOOLS, SOCIALIZATION, AND CURRICULA

While some argue that girls simply aren't interested in PCEM careers, evidence indicates that other factors are operating. For example, in their study of 1,500 mothers and children in the U.S., Jacobs & Eccles (1992) demonstrated that parents tend to rate their sons' mathematical abilities higher than that of their daughters', which can in turn affect children's self-perceptions. A report from the British Columbia Teachers' Federation, while recognizing that gender stereotyping is not caused by public schools, concluded that "a stunning amount of gender stereotyping remains in British Columbia's public educational system, from kindergarten through graduate school and beyond" (Schaefer, 2000).[51] In a meta-analysis of gender socialization in schools, Stromquist (2007) found that teacher-based dynamics (e.g., attitudes, expectations) and their interactions with students in the classroom demonstrate gendered patterns, generally to the disadvantage of girls (Stromquist, 2007). For example, Etzkowitz *et al.* (2000) argue that "many teachers unconsciously reward compliance and cooperation from girls, while encouraging or condoning a highly competitive style of interacting for boys." Further, pedagogical techniques that work well for some students may not be as effective for those from "historically nondominant groups" because of gaps in how knowledge is discussed at home and in the classroom, and varying perceptions and definitions of "science" across cultures (NAS, 2011). Given that patterns of discourse vary across social groups, evidence highlights the importance

51 With this in mind, the Panel noted the recent focus on the challenges that Canadian boys face in school, a phenomenon that may correspond with the higher percentage of women than men who are enrolled in post secondary education. Gender stereotypes can also disadvantage boys, such as when performing and behaving well in school is equated with being feminine. In comparison to young women, young men who responded to Canada's *Youth in Transition Survey* (Bowlby & McMullen, 2002) reported that they were less interested in what they learned in school and were slightly less likely to see the utility of the information. Young men also had higher high school dropout rates than young women. While some experts point out that it is still "a man's world" and that men will likely continue to ascend to positions of power, Paul Cappon, President and CEO of the Canadian Council on Learning, argues that recognizing the problems boys encounter at school does not diminish girls' achievements; rather, it is important to note when any group is falling behind (in Abraham, 2010).

of encouraging students to integrate their own culturally-based linguistic tools and points of reference into the classroom, and capitalizing on the individual interests and identities of a diverse student body (NAS, 2011).

In sum, home and school environments, sociocultural attitudes, and beliefs regarding gender roles and the value of education affect gender differences in academic choice and performance. Self-confidence, test scores, and ultimately post-secondary and career choices are often by-products of these factors (UNESCO, 2007). The lack of women in science and engineering — and the lack of men in education studies and humanities — could be a result of gender bias during childhood and teen socialization (Vallès Peris & Caprile Elola-Olaso, 2009).

Box 4.2
The Access Program for Women in Science and Engineering (WISE) at the University of Manitoba

Since 1990, WISE, an outreach group at the University of Manitoba, has been working to encourage young people's interest in science via summer camps and school workshops. Each year, WISE reaches more than 20,000 students from dozens of communities across the province, including five First Nations.

One of the programs, *Kid-Netic Energy Girls*, is a weekend club for girls in grades four to seven to learn more about science through activities, field trips, and mentors. In order to provide role models, content is delivered by young women undergraduate students who study science and engineering at the University of Manitoba.

Several programs such as this one exist across Canada, some of which represent success stories, and others which hold possibility for change.

Source: WISE, 2010a, 2010b.

Gender Sensitivity in Teaching

In addition to including gender mainstreaming principles in policy documents, some countries in the EU, such as Sweden, the U.K., and parts of Belgium, specifically address gender issues during teacher education programs. Austria has a gender mainstreaming policy that mandates that gender sensitivity must be an element of teacher education; teachers in the Netherlands must meet competence levels that include a gendered dimension; and France's teacher education institutions

have gender equality missions (Eurydice, 2010). Spain has a strategic plan on equal opportunity provision, a component of which includes guidelines that encourage the creation and integration of gender-sensitive materials to be used in teacher education courses, and Portugal and Finland have similar initiatives.

Overall, however, gender sensitivity does not appear to play a strong role in teacher education policies or professional development activities in Europe. Rather, its inclusion is more a result of the decisions of teacher education providers (Eurydice, 2010). Some professional development programs also integrate gendered dimensions. For example, the purpose of the Gender Network within Austria's Innovations in Mathematics, Science and Technology Teaching (IMST) project is to enhance learning for both boys and girls in these subject areas and ultimately narrow the gender gap.

In Canada, diversity initiatives are being implemented in some provincial education systems. As of 2008, only 43 of the province of Ontario's 72 school boards had an equity policy. The degree to which they were implemented ranged from page-long statements to lengthy documents, resources, and guidelines (OME, 2009). As a result, an equity and inclusive education strategy for Ontario schools was created in 2008, with the goals of shared and committed leadership by the ministry, boards, and schools; equity and inclusive education policies and practices which support positive learning environments; and the implementation of accountability and transparency mechanisms to measure success (OME, 2009). Examples of actions to promote equity include the Peel District School Board's six-month program for grade five students to study "racism, sexism, ableism, and other 'isms'" through social studies and the arts, and the Greater Essex County District School Board's mandatory workshop for new teachers, entitled "Diversity Matters" (OME, 2009). Some Canadian faculties of education have introduced gender sensitivity into their programs. The University of Toronto's Ontario Institute for Studies in Education (OISE) houses a Centre for Women's Studies in Education, with the goal of fostering feminist teaching, scholarship and activism related to education (OISE, 2012), and the University of British Columbia's teacher education programs are "predicated on commitments to gender equity, cultural diversity and equitable access to learning by all" (UBC, n.d.b.).

Student Knowledge About Career Futures

A 2010 NSERC study found that similar numbers of male and female grade 12 students enrolled or wrote exams in mathematics, biology, chemistry, and physics in Canada (Table 4.1). Contrary to a widespread misperception, these data at the

aggregate level generally support the point that young women in recent years are not "streamed out" of science and mathematics courses in high school, although physics remains an anomaly.[52] As the authors of the NSERC study note, these gender patterns in biological sciences and physics are replicated at the undergraduate level, but higher numbers of female students in math and chemistry at the high school level do not translate into higher numbers of women in these subjects at the post-secondary level. The Panel observes NSERC's statement that this phenomenon warrants further investigation. Considering that courses such as biology or math are prerequisites for entry into a variety of programs at Canadian universities, the Panel noted that data on female and male enrolment in higher math courses such as calculus may be more illustrative of students' interest in future PCEM careers because of its specificity and relevance for future study in these fields.

Table 4.1

Female and Male Secondary Students in Selected Fields

This table depicts the number of students, enrolled in mathematics, biology, chemistry and physics or writing grade 12 provincial exams (grade 11 in Quebec) in these subjects. This table also shows the percentage of female students enrolled or writing exams in these courses.

	Male	Female	Female (%)
Mathematics	161,642	146,474	47.5
Biology	35,440	58,422	62.2
Chemistry	51,126	57,163	52.8
Physics	46,212	29,311	38.8

(Adapted from NSERC, 2010)

Results from the *Operation Minerva* mentorship initiative in Alberta indicate that, while 91 per cent of the participants (all female) planned to pursue some science during their post-secondary education and 89 per cent were considering a career in science, only 60 per cent planned to enrol in at least three science and mathematics courses in high school (MacDonald, 2008). Although Table 4.1 indicates that female and male students enrol in math and science courses in relatively similar proportions to each other, there appears to be a disconnect between the decisions some students make at the secondary level, and their post-secondary goals. Some of this disconnect is explained in *Right for Me?*

52 See NSERC (2010) for provincial data. The Panel noted that there are some provincial disparities as well as socio-economic differences that affect student performance (see PISA, 2006). In Canada, school curricula are set by the provinces, and high level math courses may not be available to students in all communities. As a result, some students may be more prepared than others for PCEM education at the university level.

(Tomas & O'Grady, 2009), a report commissioned by Engineers Canada and the Canadian Council of Technicians and Technologists. The authors examined attitudes of young women towards mathematics and science and towards careers in engineering and technology. They concluded that, instead of factors such as gender bias in curricula, male dominance in mathematics and science classrooms and peer-influence, young women's choices are more affected by negative perceptions of engineering and technology occupations, a poor understanding of what these careers entail, a lack of role models who encourage them to engage with science and math, and the influence of broad cultural factors (See Box 8.1, Misperception #3). As one woman engineer articulated, "You aren't exposed to many engineers on TV, movies, radio, or anything that would promote the profession that a high school student would be aware of" (Personal communication, interview,

Box 4.3

Barrier-Breaking Programs that Increase Scientific Awareness Among Young People in Canada: Actua

Actua's mission is to increase the awareness of science, engineering, and technology among young people in Canada. In particular, the organization focuses on girls, young Aboriginal people, at-risk populations, and those who live in rural and Northern communities by providing positive, hands-on learning experiences. Through its network of 33 members at post-secondary institutions across Canada, it has delivered relevant and innovative programs to over 225,000 young people in over 450 communities across Canada (Actua, n.d.). Following are the results of a survey of over 876 Actua day camp participants from across Canada (from Crombie *et al.*, 2003):

- 66 per cent of participants reported increased confidence after camp;
- 64 per cent indicated an increase in their beliefs about the importance of science;
- 80 per cent stated that the camp experience would help them do better in science class the next year;
- 83 per cent said they were more likely to take optional science courses in high school; and
- 78 per cent believed they were more likely to consider studying science or technology in university.

September 2011)[53]. Compared to other sectors, academia has the highest concentration of women in research careers, but the spotlight of popular culture rarely shines on the halls of the academy.

The lack of understanding among students about what the necessary preconditions for PCEM careers are, as well as what PCEM careers entail, is unfortunate. It is important for students to be empowered with this information before they enter university, because of the educational foundations that are laid in these years. A global survey from the American Institute of Physics is illustrative of this. Of the nearly 15,000 male and female physicists from 130 countries surveyed, about 75 per cent of respondents considered a career in physics before entering university (Ivie & Tesfaye, 2011). These findings point to the importance of encouraging girls and boys to build awareness and interest in science before or during secondary school.

Some Canadian companies are reaching out to young people to create a more positive perception of science and engineering careers, and to build understanding of what these careers entail. Through interviews with engineers and human resource professionals, the Panel discovered how organizations speak to younger generations about the scope of science, engineering, and technology careers (Personal interviews, September 2011). Examples include:

- setting up booths at events and holding on-site contests to promote awareness;
- hosting "bring your kids to work day" where children shadow a family member at their workplace and receive information on resume writing and career skills;
- providing on-site assistance at science and engineering competitions at local schools;
- participating in co-op programs with universities;
- assisting with mock interviews and hosting information sessions at post-secondary institutions;
- offering paid internships to promising students;
- sponsoring post-secondary scholarships (offered nationally and internationally); and,
- subsidizing career centres related to their field at universities.

While these initiatives are not specifically geared towards recruiting young women, the Panel agreed that these outreach measures represent positive steps towards broadening the pool of students with an interest in engineering.

53 This interview was held between a Panel member and a woman engineer in the private sector as part of the Panel's evidence-gathering process.

Box 4.4
NSERC Chairs for Women in Science and Engineering

Considering that the choices students make in high school are central to their academic futures, these years are important ones in the research career trajectories. Partly in recognition of this, NSERC created its program of five regional Chairs for Women in Science and Engineering (CWSE) in 1996. The program was established to encourage girls and women into these fields, to retain them in these disciplines, increase their profile in academia and the workplace, and to eliminate gender barriers. Some of the current research projects include a national survey of science and engineering graduate students, as well as a study of Canadian institutional support indicators with statistics for recruitment, retention, tenure, and promotion (NSERC, 2011a).

CWSEs develop programs that are suited to the Chair's region, home institution, and personal experience. There are common elements to their programs, but each Chair develops unique aspects of the program. As Chair for Ontario (2003-present), Valerie Davidson (2011) summarizes the results of her initiatives in *Joining WiSE Conversations*. Through programs geared towards Early Enthusiasts, Interested Intellectuals and Productive Professionals, Davidson, her staff and volunteers have connected with 56,500 participants — of which 33,600 were female. In her closing remarks she states: "I know that the current generation of female students in science and engineering is capable and competent. These women will be successful wherever they choose to focus their careers. However, I wonder if the impact of our work will be sufficient to retain them. If they move on to where their talents are better nurtured and the culture is more welcoming, it will be a loss to science and engineering as well as Canadian society."

4.4 THE POST-SECONDARY EDUCATION SYSTEM

Recruitment

Moving through the life course, the Panel focused its attention on women as students in post-secondary education. They found that images and norms that certain disciplines such as mathematics, physics, or engineering convey may dissuade some previously interested women from pursuing post-secondary education in these fields. For example, in the U.S., few women come to college intending to major in physics (Whitten *et al.*, 2007). As a result, active recruitment strategies at the high school level have been recommended to attract women into this field (Hill *et al.*, 2010). Another American study concluded that outreach activities do not have to aim their recruitment efforts specifically at women to attract women

(Whitten *et al.*, 2004). Whitten *et al.* found that not all the students who expressed an interest in physics at the university level had graduated from high school with the courses required to declare a major in the field. Recognizing both this potential source of future physics majors and the barriers of linear pathways with few on-ramps, some universities have successfully targeted recruitment efforts towards interested students and increased both departmental numbers and diversity (Whitten *et al.*, 2004). As Hill *et al.* (2010) note, big differences can stem from small changes in recruitment, admissions, course work, and climate (see Box 4.5).

Box 4.5
Communicating a Broader Concept of Engineering: University of Technology, Sydney, Australia

For over 30 years, the Women in Engineering and Information Technology (WiE&IT) program at The University of Technology, Sydney, Australia, has encouraged women to consider engineering and ICT education and careers by communicating the broad opportunities and applications that these disciplines have to offer. WiE&IT does this through:

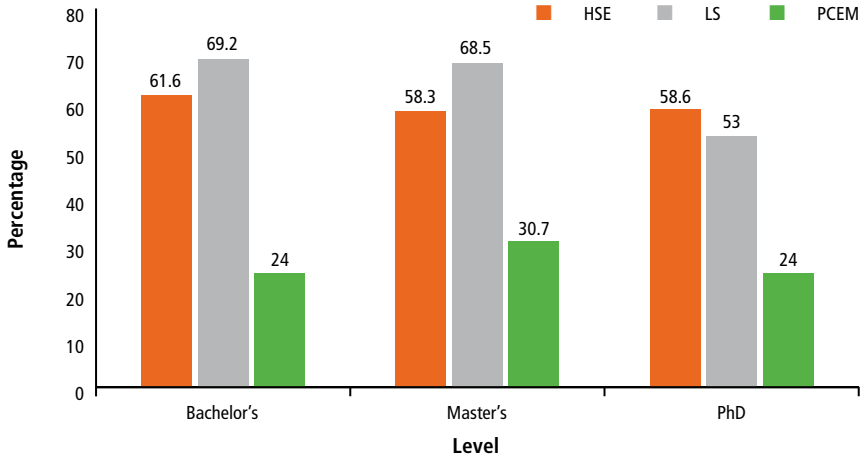
- connecting female students with university scholarship opportunities;
- hosting "Sydney Girl Geek Coffees" to connect and support women in non-traditional disciplines;
- administering a mentorship program that exposes young women to women of influence with diverse career paths;
- organizing speakers programs that aim to "demystify" engineering and ICT careers for female high school students; and
- supporting international programs and seminars that emphasize the value of engineering in a variety of countries and contexts.

Source: UTS, n.d.

Student Enrolment

In the academic year 2008–2009, women accounted for 58 per cent of all students in bachelor's and master's degree programs. Between 1972 and 2008, women have increased their enrolment into Canadian PhD programs by 800 per cent (from about 2,000 to about 18,000, versus 150 per cent for men, from 8,000 to about 20,000). By about 2008–2009, women accounted for 46.7 per cent of students at the

PhD level, and are very close to parity with men. As evidenced in Figure 4.1 (Statistics Canada, n.d.b.), the attrition rate differs among the disciplines. In HSE and LS, women substantially outnumbered men at both the bachelor's and master's degree level. In 2008–2009, 61.6 per cent of students at the bachelor's levels in HSE and 69.2 per cent in LS were women (Figure 4.1). These figures indicate that Canadian female students were not leaving the HSE or LS fields between high school and undergraduate studies. This pattern continued at the master's degree level, and for those in HSE, at the PhD level. Readers will note that there is a 15 percentage point difference in female enrolment in LS between the master's degree and PhD level; however, female doctoral degree enrolment in this field remained at over 50 per cent (Statistics Canada, n.d.b.).



(Data Source: Statistics Canada, n.d.b.)

Figure 4.1

Student Enrolment in the Three Major Fields of Research in Canada

This figure depicts the percentage of women studying full time at the bachelor's, master's and PhD levels in 2008–09 in the three major fields (HSE, PCEM, LS). It captures individuals in the population aged 15 and over in Private Households in Occupied Private Dwellings, persons with a doctorate who were employed full-year, full-time and for whom the occupation is "university professor." In addition to professors, it includes heads of departments, but excludes faculty deans as well as teaching and research assistant (see Appendix 1 for further details).

The situation was markedly different in PCEM. PCEM is the large field of study where the the proportion of women grew the fastest between 1972 and 2008; however, readers are asked to bear in mind that the percentage of women enrolled in PCEM doctoral programs in 1972 was merely 5.5 per cent. In 2008–2009, women

were outnumbered by men at the bachelor level (24.0 per cent), master's level (30.7 per cent), and at the PhD level (24.0 per cent). Of note, a similar (if small) percentage of women enrolled in PCEM at the bachelor level and at the doctoral level. This indicates that women who enrol in PCEM degrees are likely to continue their studies at the graduate level. This is an important point which speaks to the significance of attracting young women to PCEM disciplines before they enter post-secondary education.

Sources of Financial Support

In Canada, about 50 per cent of both male and female students rely on fellowships and scholarships as their primary source of income (Statistics Canada, 2007–2008). Since these awards are largely based on merit, these findings suggest that there is no obvious difference in scholastic excellence at this stage. In terms of student financial sources other than scholarships, gender differences do exist. A higher proportion of male students (24 per cent) than female students (16 per cent) depended on research or teaching assistantships whereas a higher proportion of female students (12 per cent) relied on personal savings or a partner's earnings than did male students (6 per cent). Panel Members suggested that the former difference may be a result of higher paid or more abundant teaching assistantships or research positions in fields that male students are more likely than female students to engage, but statistical evidence still needs to be collected to support this hypothesis. Whether these differences lead to greater financial challenges for women completing their PhD programs remains to be determined.

In a similar assessment of funding, McKenna *et al.* (1990) examined the rates of applications and success for graduate studentships, research funds, and salary awards in the health sciences from several Canadian granting sources. They found that women's success rates were proportionately similar to men's when they applied for grants, but the numbers of women and men who applied for these grants were very different. In addition, equal numbers of women and men applied for graduate studentships, but the number of women who competed declined at every career point thereafter.

The Culture of Physical Sciences, Computer Science, Engineering and Mathematics

Organizational sub-cultures, as well as values, norms, and assumptions, are important factors to consider in terms of the attraction and retention of women in the PCEM fields. For example, Margolis and Fisher (2002) argue that computer science departments propagate "geeky" stereotypes that reflect the interests and goals of a small population of men who have exhibited a strong passion for the subject since their teenage years. Conversely, evidence indicates that women tend to

have a different relationship with computer science, where they are more gradually drawn into the field over time (Margolis & Fisher, 2002; Hill *et al.*, 2010). Currently prevalent teaching methods, created and accepted by the traditional computer science research community, can serve to further alienate women students. These include focusing on technical aspects early in the curriculum, and leaving the practical application of principles for later (Hill *et al.*, 2010). Women tend to be more likely to express an interest in the wider application of principles; thus, this approach can be questionable for women in general and for men who are drawn to the discipline in a broader context (Margolis & Fisher, 2002).

A female project engineer spoke to this point: "There's a lack of understanding of how diverse the industry is — meaning only seeing the perception that an engineer is a male geeky-looking guy with a pocket protector and glasses — working out in the field fixing machinery and driving trains" (Personal interview with Panel, September 2011). The first NSERC Chair for Women in Science and Engineering at the University of New Brunswick, Monique Frize, elaborated, "Demystifying the work of engineers, especially in fields where women are least represented, and demonstrating the human side of what engineers do may create images through which young women can envisage comfortable roles for themselves" (Frize, 2009).

Box 4.6
International Institutional Response: Center for the Study of Women, Science and Technology (WST), at the Georgia Institute of Technology, U.S.

Created in 1999, the Georgia Tech Center for the Study of Women, Science and Technology connects issues of science and technology with those of gender, culture, and society. In addition to seminars, the Center encourages research collaboration between students and faculty, promotes a WST minor that examines science culture, diversity, and the "human side" of science, and supports the development of students through programs such as the WST Learning Community (WST Lrn C). In order to build a supportive community for young women in an otherwise male-dominated environment, women from any major who are interested in WST Center programs may apply for housing in the WST Lrn C. There, young women gain access to personal and academic support networks, mentoring and tutoring, academic and community events, and the opportunity to live with peers who share similar interests and experiences.

Source: CSWST, n.d.

Expectations based on stereotypes, a male-dominated environment, and a narrow focus on particular technical aspects of the subject can all contribute to the alienation and lower confidence that some female students report (Hill *et al.*, 2010). In addition, various studies have found that female undergraduates have less confidence in their computer, mathematics and science abilities than their male counterparts, despite equal or superior performance (as reviewed in Singh *et al.*, 2007). In addition, a Canadian study by Darisi *et al.* (2010) found that female graduate students in science and engineering experience lower levels of self-efficacy and confidence than their male counterparts (see Box 8.1, Misperception #3). Considering this evidence, grading policies that indicate how students perform relative to their classmates can help students make realistic evaluations about their fit in the field (Barker & Cohoon, 2009).

4.5 MENTORSHIP

Despite some of the negative issues related to stereotypes and the lack of understanding or preparation among students for PCEM careers, there are strategies that can positively influence the career trajectories of women as students and as researchers. Across multiple points during the life course, mentorship provides women and girls with opportunities to see other women engaged in research and also build career and social connections.

Box 4.7
Promoting Women's Networking in Alberta: Operation Minerva

Founded in 1988 in Calgary, Operation Minerva promotes women in science through job shadowing, conferences, essay contests, and a *Mentor of the Millennium* program. Operation Minerva not only matches young women with female science mentors but also works to build networks among female students and provide information to parents, teachers, and the public about careers in science. Its ultimate goal is to increase the number of girls pursuing technical careers.

Sponsored by NSERC, the program has earned the Science and Technology Awareness Award from the Alberta Science and Technology Leadership Award Foundation.

Source: AWSN, 2006.

The importance of role models in encouraging young women in research should not be underestimated. Canadian researchers Ghazzali and Myrand (2009) identified six factors linked to the underrepresentation of women in science and engineering; of these, two are related to mentorship. Xie and Shauman (1997) showed that increasing the proportion of women in traditionally male-dominated fields can propel young women toward these occupations. The "success breeds success" argument has been made regarding women from politics to law to medicine to academia.

Box 4.8
Virtual Mentorship in Quebec: Academos Cybermentorat

Academos Cybermentorat is an online mentoring program used in high schools and several CÉGEPs in Quebec to promote vocational guidance and student retention among 14 to 30-year-olds. The program pairs participants with mentors who inspire young women and men through knowledge transfer and solidarity. These volunteer mentors provide information on the types of occupations, the pathways to them, and the realities of working within them.

A 2008 survey found that 82 per cent of participants reported that their mentors encouraged them, and over 80 per cent said that they received helpful information about workplace realities. The program has received several awards in recognition of its success.

Source: Academos, 2010.

Larose *et al.* investigated the short (2008a) and long-term (2010) results of the formal mentoring program, *Programme de Mentorat pour l'intégration et la Réussite des Étudiants en Sciences* (MIRES), designed for students in their first college year in science in Quebec. Short-term effects included higher motivation and success rates and better adjustment to the transition between high school and college; long-term outcomes included the persistence of higher motivation levels and increased levels of self-confidence. For female students in particular, long-term effects included improved self-knowledge and vocational well-being.

The researchers also investigated the factors that influence the effectiveness of mentoring (Bernier *et al.*, 2005; Larose *et al.*, 2008b), which included the mentor-protégé interpersonal relationship, the mentor's personal qualities, and the protégé's background and attitude toward peer support and learning. At the graduate level in Canada, Darisi *et al.* (2010) examined the factors that affect women and men's commitment to science and engineering. Support from advisors emerged as the most consistent predictor of positive outcomes for students, in terms of intent to continue in their field of study and confidence in finding a related career. Qualitative results also indicated that advisor support had a strong influence on student experience, especially in terms of student feelings of motivation or discouragement and commitment or ambivalence to their program. The authors did not find any gender differences in terms of the degree of advisor support received, or any differences in terms of cross-gender student-advisor dyads.

Box 4.9
Charting a University Path in Quebec: Future Ingénieure?

Future Ingénieure? (Future Woman Engineer?) is a mentorship activity that aims to demystify the engineering profession for CÉGEP students in Quebec. The program gives young women the opportunity to spend part of a day with one or more engineers, in the field of her choice. The visits are held in winter, to coincide with the end of the main application period for Quebec universities. In 2010, the NSERC-Industrial Alliance Chair for Women in Science and Engineering in Quebec matched 12 students with six businesses and research centres in Quebec.

Source: Ghazzali, 2010; please see also Chaire Marianne-Mareschal (2008) (French only).

5

Institutional Practices and the Research Environment

- Chilly Climates and Women Researchers
- The University Landscape and Research, Teaching, and Service
- Earnings, Salaries, Grants and Gender
- Mentorship and Professional Women Researchers

5 Institutional Practices and the Research Environment

Chapter Key Messages

- Gender stereotyping, devaluation, and social and professional exclusion can contribute to the chilly climates experienced by some women researchers — even women at the top of their careers, and especially women in male-dominated fields. As is the case with girls and young women, mentorship is an important strategy to diminish the challenges of chilly climates for women researchers.
- Women researchers in Canada are overrepresented among part-time university professors, and underrepresented at the highest levels of academic scholarship, including in tenured positions.
- A significant body of work indicates that gender bias in hiring and promotion can put women at a disadvantage in terms of their career progression. Evaluating whether overt or hidden biases exist, and recognizing the causes, are important steps in overcoming these obstacles and ultimately encouraging more women into fields where they are underrepresented. This will broaden the pool of excellence. Illustrative practices from the United States that address gender bias include the STRIDE Committee and the ADVANCE program.
- Teaching, research, and service are requirements for university careers. However, research outputs tend to be disproportionately rewarded in tenure assessments. Time spent on these responsibilities varies by institution and discipline, but evidence indicates that women tend to spend more time than men on university community service commitments. This leaves women with less time to conduct research.
- A small but persistent gender earnings and salary gap remains in Canadian universities. The establishment of anomalies funds represents an illustrative practice to address gender-based salary inequities.
- Generally, Canadian women and men experience similar success rates in their Tri-Council grant applications. However, the propensity to apply for research grants differs as a function of gender and discipline. An illustrative practice in terms of encouraging gender equity in research grants includes the recent actions of the Canada Research Chairs Secretariat, in terms of target-setting and the 2011 recognition process.

5.1 CHILLY CLIMATES AND WOMEN RESEARCHERS

Moving through the life course, this chapter focuses on the experiences of female faculty members and postdoctoral students. The Panel found that gender stereotyping, devaluation, and social and professional exclusion contribute to the

chilly climates experienced by some women researchers, especially those in male-dominated fields (Milligan & Leckie, 2004). The data set from which the Panel drew its evidence regarding the prevalence of chilly climates was derived from qualitative sources, and much of the data was gleaned from women's personal testimonies. According to results garnered by the Task Force on Female Faculty Recruitment at the University of Waterloo, female professors indicated that they are often reluctant to discuss these feelings of isolation and frustration "because they and others perceive that it is their problem" (UofW, 2002).

Chilly climates do not manifest themselves in a single way; rather, they have evolved with time and are contingent upon social norms and values, institutional policies, and individual actions and reactions. At the University of Western Ontario's 2004 Symposium on Women in the Sciences and Engineering, the keynote address included the following statement: "Women who work in predominantly male departments confront patterns of behaviour that effectively keep them on the periphery of crucial networks of communication and social interaction" (Milligan & Leckie, 2004).

As evidenced in academic women's life-writing, a substantial number of women perceive chilly climates and alienation. For example, Canadian philosopher Christine Overall of Queen's University, Australian historian Jill Ker Conway, and Canadian law, native studies and sociology professor Patricia Monture are examples of three successful academics who published book-length memoirs. Hundreds of others have contributed personal essays to multiple-authored collections such as *A Fair Shake: Autobiographical Essays by McGill Women* (Gillett & Sibbald, 1984), *Despite the Odds: Essays on Canadian Women and Science* (Ainley, 1990), *Seen but not Heard: Aboriginal Women and Women of Colour in the Academy* (Luther *et al.*, 2003), and the academic women's Canadian blog *hook & eye* (www.hookandeye.ca). Robbins *et al.* (2011) summarize the recurring themes in these memoirs and essays:

- isolation and feelings of not belonging (being deprived of a peer group, role models, mentors, and encouragement), which can lead to lack of self-confidence, because of intersecting oppressions — gender, ethnicity, indigeneity, class, sexuality, family status, disability, etc.;
- unfair divisions of labour in academia and at home, so that women's career trajectories are slowed by greater domestic responsibilities, heavier student demands, lower pay, and less job security — "trap doors" and glass ceilings;

- sexual harassment, as well as other safety issues that affect mental health and productivity (e.g., not working late on campus due to discomfort or fear of working or walking alone); and
- the "accumulation of disadvantage" (Valian, 1999): not only being discriminated against — but also threatened with violence (see Raboy, 1993: on the 1989 Montréal Massacre, during which 14 female engineering and science students were killed by a gunman) — and having to use up precious time and energy to try to right persistent wrongs, including sexism and racism, while being held to higher professional standards because of prejudicial "schemas" or stereotypes.

Box 5.1
On Chilly Climates

"When I entered university I assumed that one could expect to be treated equally, fairly, and respectfully, without prejudice, bigotry, and racism. I was wrong. Unfortunately, what I encountered in the classroom was a microcosm of race and gender relations in society with all its complications and paradoxes."

Donna A. Murray, Communications Instructor, on her experience as a woman of Aboriginal heritage in the university setting (in Wagner *et al.*, 2008).

In terms of the relationship between these gender stereotypes and organizational conditions, factors such as workplace culture, values, climate, and labour relations may affect the retention of women in traditionally male-dominated environments. Consider, for example, the gendered engineering environment (Powell *et al.*, 2004; Faulkner, 2000). The assumption is that it is constructed around models that emphasize the prototypically masculine characteristics of independence, risk-taking, aggressiveness, and rationality, with which women may have more difficulty self-identifying and fitting in (Kvande, 1999). A Harvard University study of 1,800 junior faculty at 56 universities found that women in science, technology, engineering, and mathematics (STEM) were less satisfied than men with 10 out of 10 climate-related factors, with significant negative differences emerging in the categories of sense of fit, opportunities for collaboration with senior colleagues, and the fair treatment of junior faculty (Trower in Hill *et al.*, 2010). The Panel noted that the lack of women in university administrative positions may also contribute to chilly climates, considering that administrators can function as

"gatekeepers" to space and resources.[54] Resource allocation appears to differ across gender lines. The American Institute of Physics study of 15,000 physicists from countries around the world found that a smaller percentage of female than male physicists had enough of each of the following resources to conduct their research: funding, office space, lab space, equipment, travel funds, clerical support, and employees or students (Ivie & Tesfaye, 2011).

Another source of information that is illustrative of chilly climate as a factor is the Panel's secondary analysis of data collected for the *Tenth-Year Evaluation of the Canada Research Chairs Program*, Final Evaluation Report (Picard-Aitken *et al.*, 2010). The original evaluation was conducted as per the Settlement Agreement negotiated by the Canadian Human Rights Tribunal between the Canada Research Chairs program and the group of complainants in October 2006. A total of 1,416 respondents who were affiliated with the Canada Research Chairs program were surveyed in the original analysis (Table 5.1). For the Panel's secondary analysis, the qualitative components of all the original data contributed by women, about women, and relevant to issues facing women[55] were reviewed (see Appendix 5 for the text of the secondary analysis, including methodology).[56] As a result, a much higher percentage of female respondents were included in the secondary analysis as compared with the original study, and the responses specifically address challenges as opposed to a broader set of issues. Table 5.1 below shows the characteristics of the 161 survey respondents included in the secondary analysis. They represent 11 per cent of all survey respondents in the original Canada Research Chairs evaluation.

In addition, telephone interviews were conducted in the original analysis. This included 32 successful and unsuccessful Canada Research Chairs program applicants, 15 of whom were women. For the Panel's secondary analysis, notes from the interviews with all respondents who discussed issues facing women (15 in total) were reviewed with the same framework as the survey data. Interview material relevant to the themes emerging from the re-analysis of the survey data was identified to support or further illustrate those themes and incorporated into the survey data tables.

54 The inequitable distribution of resources and space among female and male faculty members was documented in, A Study on the Status of Women Faculty in Science at MIT (MIT, 1999).

55 Whether or not the respondents were female.

56 Permission was provided from SSHRC, the agency responsible for the Canada Research Chairs evaluation, to use the data for this purpose, under conditions ensuring the confidentiality of respondents.

Table 5.1

Characteristics of Survey Respondents in the Original Canada Research Chair Analysis and the Present Panel Study

Category	Original analysis (N = 1,416)	Present study (N = 161)
Type of respondent		
Canada Research Chair	1,009	123
Other type of chair	182	13
Grantee	174	13
VP Research	51	12
Granting agency		
CIHR	414	41
SSHRC	324	50
NSERC	599	57
Not specified	79	13
Tier		
Tier 1	444	39
Tier 2	536	83
Not applicable/specified	436	39
Region		
West (BC, AB, SK, MB)	374	53
Central (ON & QC)	868	87
Atlantic	117	18
Not specified or outside Canada	57	3
Gender		
Female	263	92
Male	740	31
Not specified	413	38
Agreed or strongly agreed there were barriers in design or administration	144*	

(Council of Canadian Academies)

* The Panel's analysis includes 17 people who did not agree or strongly agree that there were barriers on those questions, but agreed in a subsequent question, that they personally had experienced barriers (144 + 17 = 161).

The purpose of this secondary analysis was to enable the Panel to better understand the issues women in university research encounter as they seek to advance their careers, particularly "elite" women researchers involved with the Canada Research Chairs program. Adopting the conceptual framework used by the Panel, the author of the secondary analysis searched the primary data for issues that

may disproportionately affect women in university research, such as family and community, mentorship (or lack thereof), social capital and social schema, the research process, workloads, and grant programs. The number of respondents who identified issues in each of these areas is listed in Table 5.2.

Table 5.2

Frequency of Types of Barriers Identified by those who Agree Women Face Barriers in the Canada Research Chair Program

This table groups the original responses of those involved with the Canada Research Chair Program according to thematic area.

	No. of respondents (N = 161)
Social capital/schema: valuing by those in power of people like themselves (lack of social capital for those outside these schema). (Mentorship was merged with this category*).	40 (14)
Family/community factors: time and emotional demands or family/ home life, familial disruption for advancement, community ties.	32
Research processes: types of research, demands of the types of research conducted, that affect women more than men.	13
Characteristics of grant programs: inherent limits to access, or lack of oversight, from some programs/agencies.	10
Workload: rate of output production necessary to advance.	6

(Council of Canadian Academies)

* Please see Appendix 5 for further details.

This re-analysis, conducted through the analytical lens being used by the Expert Panel, found the most prevalent types of issues faced by women in university research, at least those in contact with the Canada Research Chairs program (40 out of 161 respondents), are related to how women researchers are valued by those in power (i.e., senior administrators in universities making decisions about nominating faculty members for chair positions, according them resources, and supporting and promoting them). There appear to be powerful social schema operating about what "model" or "star" researchers should look like, that may systematically exclude women from consideration and selection. There are also concerns about practices and approaches used by universities in locating and acknowledging brilliance that may leave excellent female researchers in the shadows. In general, these data suggest that not only is there a lack of incentive for institutions to address these barriers, there is a lack of sanctions and indeed some disincentives for them not to. The rest of the barriers identified in the Panel's secondary analysis are discussed throughout this report, according to their thematic area. Please see Appendix 5 for the full methodology and findings.

Box 5.2
Women and Institutional Support

"Women are not necessarily supported to the same degree as men. Moreover, support for women's renewals is not as certain as it is for male colleagues and some women with absolutely stellar records on any imaginable metric have been refused support for renewal without any rationale provided."

Opinion of respondent in the Panel's secondary analysis of Canada Research Chair data.

In general, the Panel's re-analysis supports the results of the original Canada Research Chairs evaluation: that some women university researchers have and continue to face systematic gender-related barriers as they seek to advance their careers. These barriers, while very real in some environments, are not rampant at the Canada Research Chairs level. Canadian researchers Grant and Drakich (2010) had similar conclusions from their study of Canada Research Chairs. They reported "While for many individuals holding CRCs, the impacts on their careers and research productivity have been quite positive; this is not a universal experience...what makes the experience 'good' for some and 'bad' or 'ugly' for others depends a great deal on individual as well as institutional (structural) considerations."

Employment, Evaluations, Career Progression and Gender

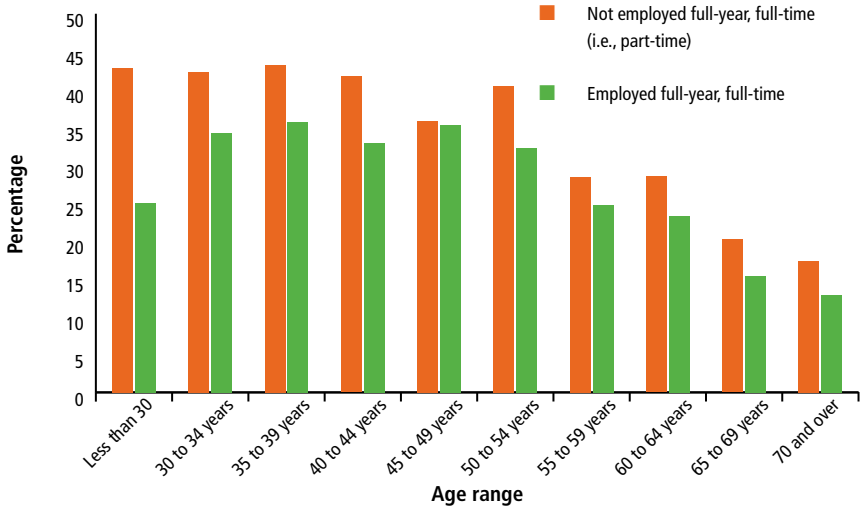
Women researchers are overrepresented among part-time university professors, and underrepresented among full-time professors (see Figure 5.1) (Statistics Canada, 2006b; 2006d). Data from the 2006 Census[57] shows women making up 30.5 per cent[58] of full-year, full-time university professors in all fields.[59] The proportion of women among part-time university professors was about five percentage points higher. This difference is even more obvious among younger women, as shown in Figure 5.1. Some individual universities publish statistics on the percentage of individuals in each rank.

57 This was the most recent data available at the time of writing the report.

58 This proportion is slightly different than the data presented in Table 3.1. This is due to different measures of the population of university faculty. Please see Appendix A1.1 for more details.

59 Individuals in the population aged 15 years and over in Private Households in Occupied Private Dwellings, persons with a doctorate who were employed full-year, full-time and for whom the occupation is "university professor." See Appendix 1 for a precise definition of a professor in the context of the census. Note: University professors' part-time data are only available from the census data and cannot be retrieved from the UCASS dataset.

For example, in 2000–2001, lecturers, instructors and sessional teachers taught 38 per cent of all undergraduate students, as well as 33.4 per cent of undergraduate course sections at Ottawa's Carleton University (Carleton University, 2005). In 2003–2004, these same groups taught 46.9 per cent of all undergraduate students, and 47.1 per cent of all undergraduate sections. If these rapid increases over time are suggestive of a general trend, issues such as job security, benefits, and career progression are likely to become an increasing concern. On a similar note, Canadian census data suggest that women are overrepresented as PhD holders who are not in the labour force in comparison to the proportion of women among PhD holders who work full-year, full-time. For example, between the ages of 30 to 39, 63.2 per cent of PhD holders who were not in the paid work force (and were not in school) were women, yet women in this age group represent about 35 per cent of full-year, full-time professionals with doctoral degrees (Statistics Canada, 2006b, 2006g, 2006h). Of note is the fact that this age bracket coincides



(Data Source: Statistics Canada, 2006b, 2006d)

Figure 5.1

Women University Professors: Full-time versus Part-time Employment

This figure shows the estimated distribution by age group of women among full-time and part-time university professors at the time of the 2006 Census. Please see Appendix 1 for further details on census data. It captures individuals in the population aged 15 and over in Private Households in Occupied Private Dwellings, persons with a doctorate who were employed full-year, full-time and for whom the occupation is "University professor." In addition to professors, it includes heads of departments, but excludes faculty deans and teaching and research assistants.

with the years during which many women tend to have children. As an additional note, 36.5 per cent[60] of women with PhDs were looking for paid jobs at the time of the 2006 Canadian Census (Statistics Canada, 2006i).

In a comparative context, research from Australia indicates that the casual university workforce is "highly gendered," where women are more likely than men to be employed in casual positions with limited options for career progression (May *et al.*, 2011). In the past 20–30 years, the structure of the academic labour market has changed significantly to the point that the majority of undergraduate teaching is taken on by casual lecturers in Australia (May *et al.*, 2011). Research from the U.S. illustrates some of the effects of this trend. A study of nationally representative faculty found that women were significantly more likely than men to not only leave their current job, but abandon academia altogether (Dryfhout & Estes, 2010). Women's stronger intentions to leave were affected by how they believed female faculty were treated at work, as well as their "smaller share of workplace rewards" (Dryfhout & Estes, 2010) in terms of rank, salary, and especially full-time versus part-time employment status. The authors found that women who expressed their intent to leave academia were likely to be those in part-time positions, which are often low paid and contingent.

Box 5.3
International Institutional Response: ADVANCE Program at the University of Michigan

Funded by the U.S. National Science Foundation, the ADVANCE program aims to improve the campus environment for faculty in four areas — equitable recruitment, retention, positive departmental climate, and development of leadership skills. Before the program was implemented in 2001–2002, 13 per cent of new tenure-track hires in science and engineering were women. This increased to 29 per cent from 2003–2010. In addition, 14 women scientists and engineers have been appointed as dean or department chair, and over 530 faculty members have attended faculty recruitment workshops.

Source: University of Michigan, 2011.

60 Not including persons on temporary lay-offs or persons whose jobs would start in four weeks or less.

One of the challenges for women researchers as they progress through the ranks relates to evaluations. Much evidence points to the idea that, in some fields, women researchers experience discrimination in terms of hiring and promotions. In 1997, Christine Wennerås and Agnes Wold's groundbreaking research found that women who applied for postdoctoral research fellowships at the Swedish Medical Research Council were systematically underrated in comparison to men during the peer review process, despite having the same productivity based on six variables. In a similar vein, Madera *et al.* (2009) examined 624 letters of recommendation for 194 women and men applying for junior faculty positions at an American university. They found that women were more likely to be described in relational or communal terms, such as "affectionate, helpful, kind, sympathetic, sensitive, nurturing, agreeable, tactful, interpersonal, warm, and caring" while men were more likely to be described in agentic terms, such as "assertive, confident, aggressive, ambitious, dominant, forceful, independent, daring, outspoken, and intellectual" (Madera *et al.*, 2009). In addition, the authors concluded that communal descriptions relate negatively to hiring outcomes, thereby demonstrating the effects that gender stereotypes have in the academic hiring process.

Similar work to investigate the "Matilda Effect," where women's scientific contributions are underestimated or ascribed to men (Rossiter, 1993) was undertaken by Lincoln *et al.* (2012). Examining the award nomination process in science, technology, engineering and medical disciplinary societies in the United States, Lincoln *et al.* (2012) found that while women's representation as recipients of awards had nearly doubled from 1999–2010, women won a significantly smaller share of research prizes than they did teaching or service prizes — a disparity that actually increased as time progressed. Men appeared to receive a substantially larger share of awards compared with their overall representation in the nomination pool. The presence of women on the award committees, especially as chairs, diminished the disparity (Lincoln *et al.*, 2012). In the case of the Canada Research Chairs program, Side and Robbins (2007) noted that 83 per cent of the 2,000 international experts appointed to the College of Reviewers were male (no other equity data on these individuals existed). From 2000–2004, and again in 2006–2007, the five person Steering Committee was composed entirely of men.[61] Considering the gender of these key decision makers, Side and Robbins questioned whether the title of "peer reviewer" was indeed accurate, and what effects this gender imbalance might have on the final composition of Canada Research Chairs. Also in Canada, Ornstein *et al.* (2007) found that disciplinary and institutional differences in promotion times matter, but even when accounting for these, female associate professors were promoted to full professor about a year more slowly than their male counterparts.

61 As of 2012, two members of the six-person committee were women (CRC, 2012a).

In *Beyond Bias and Barriers*, the National Academies' committee stated that "an impressive body of controlled experimental studies and examination of decision-making processes in real life show that, on the average, people are less likely to hire a woman than a man with identical qualifications, are less likely to ascribe credit to a woman than to a man for identical accomplishments, and, when information is scarce, will far more often give the benefit of the doubt to a man than to a woman" (NAS, 2007). The authors also pointed out that women faculty are paid less and require more years of experience to be promoted. They concluded that the ways that success is measured in systems presumed to be meritocratic may, in fact, be biased.

Considering the evidence, the Panel concluded that excellence associated with women researchers tends to be undervalued in evaluations, putting them at a potential disadvantage in terms of their career progression (See Box 8.1, Misperception #6). Evaluating whether overt or hidden biases exist, and recognizing the causes, are important steps in overcoming these obstacles and ultimately encouraging more women into fields where they are underrepresented (see Box 5.4).

Box 5.4

International Institutional Response: Committee on Strategies and Tactics for Recruiting to Improve Diversity and Excellence (STRIDE)

Since 2002, the STRIDE Committee at the University of Michigan has worked to reform hiring and promotion practices by leading workshops for those involved with the hiring process, and working with departments to improve their processes of staff recruitment and retention. Senior faculty on the committee give presentations and targeted advice about how to build a university community that "seeks, welcomes and defends diversity." Practices identified as effective, practical, and fair are summarized in a publicly available handbook, entitled ADVANCE Handbook for Faculty Searches and Hiring (2009). They include suggestions for proactive language that can be used in job descriptions, protocol for reviewing past departmental searches, how to recognize and mitigate evaluation biases when creating a short list of candidates, and tips about how to handle the negotiation process in a transparent manner.

Source: University of Michigan, 2009–2010.

5.2 THE UNIVERSITY LANDSCAPE AND RESEARCH, TEACHING, AND SERVICE

As described in Chapter 1, universities in Canada have changed dramatically since the middle of the 20th century in terms of student enrolment and faculty hiring. However, these trends are likely to change again. The baby boom echo populations (the children of the baby boomers) are now passing university age, so the current source population for university enrolments is levelling off and will even decline in absolute numbers in the next two decades (Bélanger *et al.*, 2005).

Thus, if there were no changes in enrolment propensities, universities should expect an absolute decline in the student population in demographic terms. But, as described earlier, enrolments as a percentage of the relevant source population age group have steadily and substantially increased. The most reasonable expectation is that these increases in enrolment propensity will continue, so universities are likely to continue to grow in terms of absolute enrolments, while the character of the student population will likely shift (AUCC, 2007). The Panel also noted that the diversifying student population would likely benefit from the teachings of a diverse faculty population, but as changing R&D spending rates indicate (Figure 1.3), there may be signs that Canada is moving into a new phase of more restricted growth of faculty numbers.

Increasing tuition costs and the movement toward a "consumer model" of the university has changed the job of faculty as well as the general role of universities in society (AUCC, 2007). There is increasing pressure to fulfill brand promises by providing "customer service" to students, where professors are penalized with negative student evaluations if they do not fulfill enhanced student expectations (Titus, 2008). If universities are to continue to adequately educate their undergraduates, they will need to devote more effort to undergraduate teaching and less to research. This contradicts the trend over the past four decades of dramatically increasing research intensity, implying further changes for the professoriate (Clark *et al.*, 2009).

Obviously, the more time academic researchers must devote to teaching and service, the less they have for research. Some types of teaching create synergies that enhance research output (teaching a graduate student seminar), but others detract from research productivity (large undergraduate lecture courses). Similarly, certain committees, such as student grievance committees, are extremely taxing in terms of time and intellectual and emotional energy. Others are more rewarding, such as committees that award research grants or student scholarships, allowing faculty to determine resource allocations within the institution.

Teaching and service activities are clearly necessary for an academic career. Results from a 2009 survey at the University of British Columbia indicated that faculty members care about teaching and believe that excellence in teaching should be weighted more heavily in their evaluations (Lin, 2009), but it is research outputs that tend to be disproportionately rewarded in tenure assessments (Misra *et al.*, 2011). In research-intensive institutions, faculty can expect to engage in grant writing and research as well as to develop products that are a result of their research, such as patents. Assessments of research productivity or scholarship can include the quality and quantity of publications, success in attracting external funding, awards, invitations to deliver scholarly talks, visiting professorships, and research in collaboration with government and other bodies (UWO, 2010).

Time spent on research, teaching, and university community service varies consistently across institutions and disciplines. The role of department chair, for example, is compensated by a reduced teaching workload and enhanced salary in some universities and not in others. In a survey of 2,173 faculty across eight teaching fields in 36 universities across Canada, Landry & Amara (2001) found that in terms of time allocated to teaching, research, service, and other professional activities, there are differences across fields as well as by university size. They demonstrated that the proportion of time devoted to teaching duties tends to decrease with the size of the university, whereas time devoted to research tends to increase with university size. Data were not disaggregated by gender. In terms of discipline, faculty members in the humanities indicated that they spent an average of 40.33 per cent of their time on teaching related duties, whereas those in medical and human health professions devoted 25.83 per cent of their time to teaching (Landry & Amara, 2001). In terms of research, faculty members in agricultural or biological sciences, engineering, or applied sciences and in medical and human health professions spent an average of more than 40 per cent of their time on research, whereas faculty in education and fine or the applied arts spent around 30 per cent of their time on research (Landry & Amara, 2001). This is notable, considering data from 2004 which indicates that women are slightly better represented at the full professor level (21.5 per cent) at Canadian undergraduate institutions, than at medical-doctoral institutions, (17.2 per cent), which tend to be large in size (CAUT, 2008). American evidence[62] indicates that compared to men, women faculty dedicate more hours per week to service[63] (Link *et al.*, 2007), as well as

62 Link *et al.* (2007) note that in comparison to studies that outline gender differences in time allocation between paid and unpaid work, there are a lack of studies that investigate how time at work is allocated among competing activities. They argue that the main reason for this gap is that data on how individual workers divide their work time among different activities are not commonly available.

63 Controlling for institution and discipline.

mentoring (Misra *et al.*, 2011), while men spend more time on research — with implications for career progression. On the contrary, findings from a 2010 NAS report indicate that male and female faculty members spend similar proportions of their time on research, teaching, and service. The lack of a quality time-use survey of university faculty in Canada hindered further analysis of this subject.

Women and University Service

Of all the facets of academic workloads, service commitments appear to be a particular factor of concern for female faculty members. In 2011, the Massachusetts Institute of Technology (MIT) released a follow-up report to its influential *Study on the Status of Women Faculty in Science at MIT* (1999).[64] While the 1999 report indicated that more women should be included on committees, in 2011, many female science faculty members reported that the service expectations are unrealistic considering the relatively small proportion of women faculty members to draw from. Other evidence suggests that women faculty are "offered" more low-visibility yet time-intensive service than their male counterparts (Park, 1996) and spend more time than men on service-related commitments (Link *et al.*, 2007; Misra *et al.*, 2011).

Box 5.5
On Service

"There are so few women full profs, there is a tremendous admin burden. They need women on the committees, but it stops me from being as productive."

Opinion of respondent in the Panel's secondary analysis of Canada Research Chairs data.

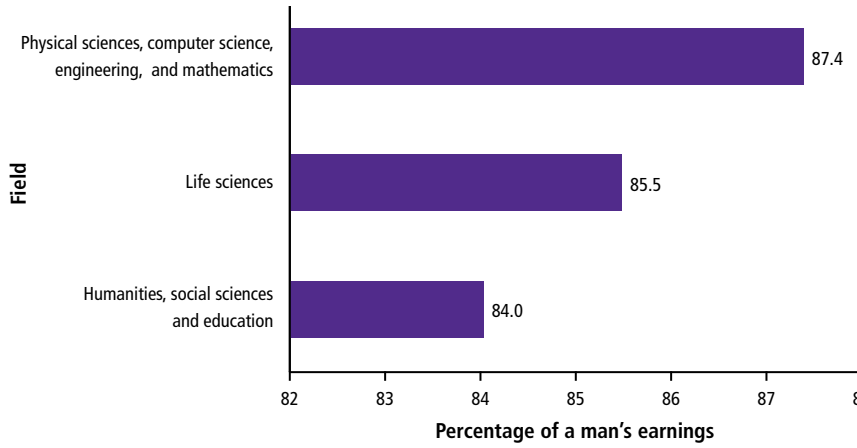
This pressure to act as change agents can be particularly pronounced for individuals from minority groups (Turner, 2002). Women, especially those from diverse backgrounds, are often expected to represent their constituencies, but, as one academic from the United States described, "issues of pedagogy and cultural diversity and gender are not the province of just women or just faculty of colour" (Turner, 2002). The challenge lies in tokenism (Kanter, 1977), as well as the numerous demands for service and research work — of which the latter is rewarded, and the former likely to be significantly less so.

64 Also known as the *MIT Report on Women in Science.*

5.3 EARNINGS, SALARIES, GRANTS, AND GENDER

Earnings

In comparison to Canadian society in general[65], the gender earnings gap in Canadian universities is less pronounced. Success in diminishing this gap should be acknowledged, and commended. However, the small yet persistent gender earnings gap that remains in Canadian universities is troublesome. Looking back to 1986, the largest earning gap was in LS, where women who were professors made, on average, 76 per cent of what men did (Statistics Canada, 1986). Women made 81 per cent of what men did in PCEM, and earnings were the closest to parity in HSE disciplines, at 83 per cent (Statistics Canada, 1986). Twenty years later, by 2006, these figures had not changed much for some women; women in HSE earned only 84 per cent of what men did. The gaps diminished in both LS (to 85 per cent) and PCEM (from 81 per cent to 87 per cent), but by 2006, parity had not yet been attained (Statistics Canada, 2006a) (Figure 5.2).



(Data Source: Statistics Canada, 2006a)

Figure 5.2

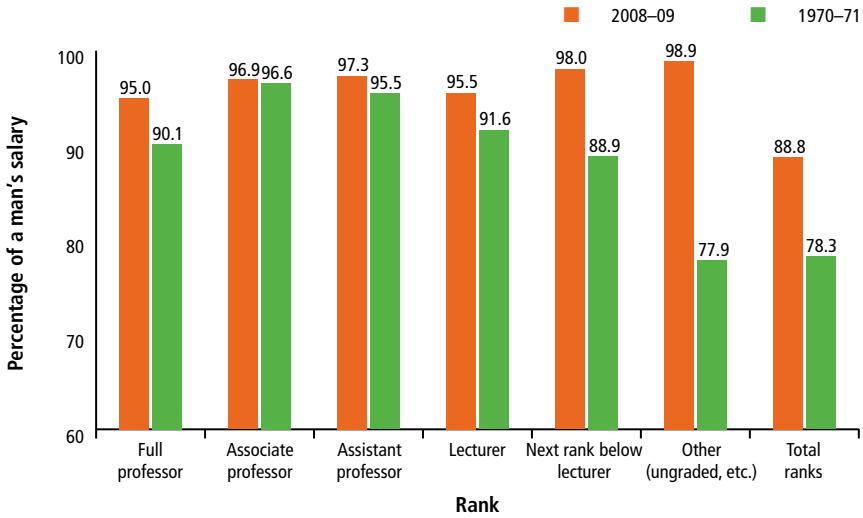
The Earning Disparity Between Women and Men Professors Varies by Field of Research

This figure depicts women's earnings as a percentage of men's at the time of the 2006 Census. For example in humanities, social sciences and education, women professors made about 84 per cent of what men did (all ranks). See Appendix 1 for further details on census data.

65 Since 1992, the female to male annual earnings ratio for full-year, full-time workers has remained relatively steady at about 0.72 (Williams, 2010). According to Statistics Canada authors Williams (2010) and Drolet (2011), this ratio may not be the most appropriate measure of the existence and size of a gender pay gap in the general workforce, because it does not ensure that equal quantities of work are being compared. For this reason, hourly wages may be a more appropriate measure of gender differences in pay. Using this measure, women made 83.3 per cent of men's average hourly wages in all employments in 2008 (Williams, 2010). This represents an increase from 75.7 per cent in 1988 (Williams, 2010). The gap shrank the most (11.5 per cent) at the lowest end of the wage distribution, and the least (6.7 per cent) at the highest end (Drolet, 2011).

Salaries

In 2010–2011, female academics made on average $106,970, or 88.9 per cent of a male academic's salary ($120,378) (Statistics Canada, 2011). However, as described in Chapter 3, there are gender differences by academic rank. The Panel chose to look at the relationship between gender, rank and pay more closely. They found that salary gaps within ranks are smaller, although over about 40 years, the gender salary gap for full professors decreased by only five percentage points (Statistics Canada, n.d.a.). In 1970–1971, women who were full professors made 90 per cent of what men in the same position made, whereas in 2008–2009, at the rank of full professor, women made 95 per cent of men's salaries. Over the same time frame, the decrease in the salary gap was slightly larger for faculty in the lower ranks. For example, the salary gap for faculty in the rank below lecturer closed by 10 percentage points from 1970–1971 to 2008–2009 (Figure 5.3) (Statistics Canada, n.d.a.).



(Data Source: Statistics Canada, n.d.a.)

Figure 5.3

Salary Disparities Between Women and Men Professors at all University Ranks

This figure depicts the salaries of women professors as a percentage of men's at Canadian degree granting institutions in 2008–09 and in 1970–71. For example, in 2008 women associate professors made about 96.9 per cent of what men did. Both faculty with PhD and faculty without PhD are taken in account in this dataset.

More recently, the Canadian Association of University Teachers (CAUT, 2011) undertook an equity review of male-female salary differentials among faculty in 2011. Using 2006 University and College Academic Staff Survey data (UCASS), CAUT found a small but persistent salary gap[66] that could not be explained by age or rank alone, and that had changed little over the past 20 years. They also found that the gap widened as women and men in the same age bracket got older (as with the labour market in general). For example, at the full professor level, a salary difference of 4.5 per cent in favour of men resulted in an annual shortfall for women of nearly $8,000. Even when adjusting for discipline, there was still a small gap which indicated that there were some constraints that disadvantaged female academics, such as small differences in negotiated starting salaries[67] which accumulate into greater gaps over time, as well as academic salary grid systems in which rewards increase with the number of years worked. Panel Members noted that salary differences can continue to affect women in their post-retirement years, in the form of lower pension payouts in comparison to men (CAUT, 2011). Women with children, of course, are not able to maintain uninterrupted career paths as easily as men.

Similarly, in an analysis of the gender pay gap at the University of British Columbia, Bakker *et al.* (2010) found a gender differential of over $14,000 in average annual salaries. While much of this gap was explained by rank, discipline, experience, and holding a Canada Research Chair or Distinguished Professorship, a $3,000 difference remained. Assuming that women and men are equally productive (as the authors' analysis of merit awards suggested), the research team considered the pay disadvantage discriminatory.[68]

66 Adjusted for inflation.

67 Iris Bohnet of Harvard's Kennedy School notes that women tend to be less likely than men to effectively negotiate for themselves, despite being proficient at negotiating on behalf of others (The Economist, 2011).

68 In addition to the wage gap, mandatory retirement rules have been cited as a constraint on female academics because of women's higher likelihood of career interruptions in comparison to men (as discussed in Worswick and Warman, 2009). For many women, fewer years worked and lower annual salaries translate into lower pension payments upon retirement. Mandatory retirement at a set age can exacerbate this disparity. American researchers Ashenfelter and Card (2002) explain that advocates of mandatory retirement argue that turnover is needed to increase the inflow of younger faculty, including women and minorities. Others argue that the practice is discriminatory (Munro, 2004). In 2005, the University of Toronto was the first university in Ontario to end mandatory retirement rules for faculty, who were previously forced to retire at 65 (Munro, 2010). This was in advance of Ontario's abolition of mandatory retirement rules for everyone (2006). Since then, many Canadian universities have followed suit, including the more recent changes at the University of Prince Edward Island and the University of New Brunswick (2010).

The salary gap appears to disproportionately affect university faculty who are also racialized minorities. The Canadian Federation for the Humanities and Social Sciences Feminist and Equity Audits (Robbins & Ollivier, 2006) reported the salary differences between university teachers in 2001. They found that on average, compared to a non-racialized man's salary (100 per cent), men who were racialized minorities earned 84.5 per cent, women who were not racialized minorities made only 68.9 per cent, and women who were racialized minorities made a mere 55.4 per cent (Robbins & Ollivier, 2006).

Twenty-five years after Justice Abella (1984) released *Equality in Employment: A Royal Commission Report*, which emphasized the importance of the principle of equal pay for work of equal value, an earnings and salary gap remains. The Panel concluded that this persistent disparity impedes the progress of women in university research, because it indicates that women researchers are not valued

Box 5.6
Gender Anomalies Fund at Ryerson University

An anomalies fund was created at Ryerson University in 2008 to address inequities in salaries relative to other members within a department, school, or faculty. Faculty members can apply for adjustments to their base salary when the individual's salary is outside the band of normal distribution compared to colleagues by age, rank, and number of years at Ryerson. In January 2012, an additional Gender Anomalies Fund for women was created. It is a special program under Section 14 of the *Canadian Human Rights Code*, to address gender-based salary differentials and systemic inequities. Ryerson is one example of a Canadian university with such a fund.

Source: RFA, 2012.

Granting

Box 5.7
Funding and Gender

"I had to negotiate more forcefully to receive the same/minimum level of funding/teaching load received by male Chairs. That said, I had many institutional allies in the process."

Opinion of respondent to the Panel's secondary analysis of Canada Research Chairs data.

equally to men. They also observed that the pay gap may affect productivity, in terms of being able to afford computer equipment and time-saving software, books and subscriptions, networking and travel costs, and elder or child care.

Grants are an important component in the career of a university researcher — the types and amount of grants obtained are important elements in the decision on awarding a tenure track position to a university researcher (Leis-Newman, 2011).[69] Grants also directly affect research productivity by providing infrastructure, salaries for technicians and students, and funds to set up collaborations. Some fields, such as the life sciences, physics, or engineering, may require substantial infrastructure and hence a large workforce (e.g., of technicians and graduate students). Researchers in those fields may have to rely more on large grants than do those in the humanities or social sciences.

Box 5.8
International Institutional Response: The Swedish Vinnmer Program

The Swedish Governmental Agency for Innovation Systems launched this program in 2007 to provide funding for over 130 women researchers. Aimed at women in academia, government, and industry who have doctoral degrees, Vinnmer's goal is to help postgraduate women attain leadership positions in research-based careers.

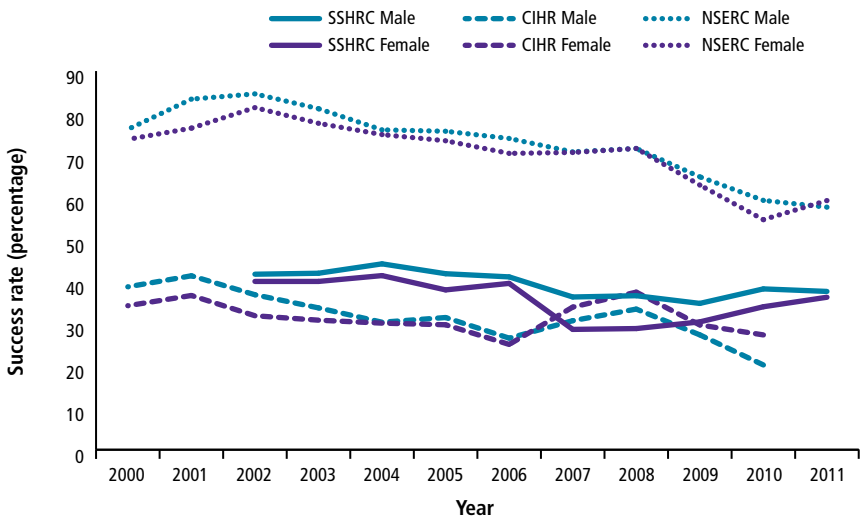
Source: Vinnova, 2007.

69 See also the following excerpt from the University of Alberta's Faculty of Pharmacy and Pharmaceutical Sciences (2009) Criteria and Procedures for Evaluations of Clinical Track Faculty:

> Research funding: The candidate has secured funding from sources outside the University to support his/her research efforts. Documentation will include descriptions of grants funded, and of grants submitted along with a description of their status including scores where relevant; comments of reviewers may be included. The role of the applicant in all funded, unfunded and submitted grants must be clearly defined. The role of the candidate in all funded grants since appointment at the University of Alberta must be clearly defined. Potential and actual revenues to the University and Faculty from intellectual property licensing should also be defined.
>
> Grants, including the number and type of grants funded and submitted, can fall under the evaluation category of "research and scholarly activity."

In order to assess if grants in Canada are an important factor affecting the career trajectories of women in university research, the Panel requested details on grant success rates from the three major Canadian granting councils. In addition to requesting data on individual grants (i.e., longitudinal data), the Panel also asked for data on grant recipiency, irrespective of which tri-council agency was the source (psychology, for example, may be funded by both CIHR and NSERC). The Panel thought that the common curriculum vitae (CV) system could provide the linkages. However, panellists were told that such data were at least a decade away. The absence of these data on grant recipiency prevented the Panel from undertaking a more in-depth statistical analysis of the factors that determine success in this major aspect of university research. The inability to provide these data marks a tremendous gap in the information base for responding now, and in the future, to the primary mandate of the Panel.

Although the graph shows some variability, overall, women and men experience comparable success rates from the Tri-Council grant agencies (see Figure 5.4 and Appendix 3 for more details on grants). With regards to NSERC and CIHR, males may have higher success rates for post-doctoral grants in some years, although again, there is some variability. However, as a result of the variability of the success rates for both genders over the last 10 year period, the Panel's analysis on gender equity in funding social science and humanities research at the post-doctoral level is inconclusive (see Table A3.1, Appendix A3 for success rates of post-doctoral fellowships).



(Data Source: NSERC, 2011; CIHR, 2011b, SSHRC, 2011b)

Figure 5.4

Grant Application Success Rates at CIHR, NSERC and SSHRC, by Competition Year

In general, these data suggest that women and men are equally likely to be awarded grants when they apply. In addition to the analysis of the grant success rates of women and men researchers, the Panel noted that another useful comparison could focus on the total amount of funding that successful women and men receive. In other words, while their success rates may be similar, there may be differences in terms of the size of the awards.

In the U.K., a funding incentive has been created to promote the advancement of women in science, engineering, and technology departments. A detailed description of this illustrative practice is presented in Box 5.9.

Box 5.9
Athena Swan Charter

The Athena Swan Charter is a scheme that recognizes excellence in science, engineering, and technology (SET) among women employed in U.K. universities. The program was launched in 2005 with 10 founding members and has since grown to 61 institutions of higher education. A pre-requisite for membership is subscription to a set of Charter principles regarding the advancement of the careers of women employed in SET departments. Universities are then eligible to apply for bronze, silver, or gold awards, which are based on action plans and assessments of performance in five key areas. As of 2011, there were 87 award-holding institutions and departments, with one gold award held by the Department of Chemistry at the University of York (Hawkes, 2011).

In a letter to the Medical Schools Council dated July 29, 2011, the Chief Medical Officer announced that all medical schools that wish to apply for funding from National Institute for Health Research Biomedical Research Centres and Units must have achieved an Athena Swan silver award (ECU, 2011). This statement provides a major incentive for the relevant university departments to meet the gender criteria required to attain this status.

Since the first award in 2006, an impact study was undertaken to record the changes in terms of the creation of gender-friendly departments and female representation within SET departments. Many of the university staff interviewed for the study reported that the good practices being implemented generally benefit all staff and contribute to improving the working environment and culture within their institutions (Hawkes, 2011). The Athena Swan approach shows the value of cooperation between universities, learned societies, and funding councils.

Canada Research Chairs Program Grants

In terms of gender and Canada Research Chairs program grants, a few respondents (10 out of 161) in the Panel's secondary analysis of Canada Research Chairs data mentioned that some characteristics of grant programs were problematic, such as the lack of oversight or reporting requirements from the granting agencies, or from within the institutions, to ensure that equity was addressed. Their responses indicated concerns with program design, and specifically, that the nomination process was carried out by universities: "The nomination process does not have a mandated open competition, so at some institutions candidates are selected from those known to the upper-level administrators (disproportionately white, male, and able-bodied), leading to an inherent bias" (See Appendix 5 for further analysis). While few respondents in the Panel's secondary analysis identified these issues as problematic, a three-year long human rights complaint lodged on behalf of several equity groups indicates that others find this to be a very serious issue (see Box 1.1).

Box 5.10
Canada Research Chair Equity Target Setting and Recognition Process

Created in 2011, the Canada Research Chairs Recognition Process is a voluntary component of the mandatory equity target setting exercise that was implemented as a result of the 2006 settlement agreement. Through this process, the Canada Research Chairs Secretariat will highlight small, medium, and large universities that have exemplary equity practices in terms of the recruitment, nomination, and appointment of Canada Research Chairs. One institution per year will be selected and will receive a certificate and an invitation to present its equity practices at a national conference. The institution will also be profiled on the Canada Research Chairs program website and will be granted the use of an email logo indicating that they have been recognized for their exemplary practices (CRC, 2011b).

As discussed in Chapter 1, a human rights complaint was lodged against the Canada Research Chairs program in 2003 on the basis that, contrary to Section 5 of the *Canadian Human Rights Act*, the program was discriminating against

individuals who were members of the protected groups (Morgan, 2003). An out-of-court settlement agreement was reached in 2006, requiring that the federal government's policies on non-discrimination and employment equity become a part of the Canada Research Chairs process. This reaffirmed commitment to equity in research on behalf of the federal government has been followed by ongoing measures to ensure that fairness is a part of the recruitment, nomination, and selection process, as indicated in Box 5.10.

5.4 MENTORSHIP AND PROFESSIONAL WOMEN RESEARCHERS

Recall that the Panel highlighted mentorship as a positive factor for girls and young women. In response to the barriers described throughout this chapter, and in addition to the other illustrative practices highlighted throughout this report, the literature indicates that mentorship and sponsorship initiatives are positive factors that can affect the career trajectories of women researchers.

Kram's mentor role theory (1985) organizes mentoring into two categories: psychosocial and career. Psychosocial mentoring includes role modelling, friendship, and counselling. Career mentoring includes providing protégés with challenging assignments, coaching, visibility, exposure, protection, and sponsorship. Both strategies are important for women in research positions, although as a facet of career mentoring, sponsorship appears more frequently in literature pertaining to the private sector.

Evidence from longitudinal studies indicates that strong mentoring relationships have positive effects, such as increased rates of publication and tenure, and lower attrition rates (NAS, 2007; 2010). Support from role models appears to be particularly important during the critical process of PhD and post-doctoral completion, due to the positive effect on career progression (Caprile & Vallès, 2010), and a significant body of work in Canada and the U.S. links mentorship practices with the improved representation of women as faculty in certain academic disciplines (Ghazzali & Myrand, 2009; Mandleco, 2010). Other research from the U.S. found that women academics discuss their salaries, benefits, and research with their colleagues less often than do men, making the advantages of mentorship for women clearer (NRC, 2010). Recognizing the importance of mentorship, some university departments have implemented formal mentoring schemes (see Box 5.11).

Box 5.11
Mentorship: Official Policies at the University of British Columbia

Some Canadian university departments have specific policies on faculty mentoring. For example, the University of British Columbia's (2008) policy within the Department of Anesthesiology, Pharmacology and Therapeutics states that "Each new faculty member should have a welcoming, supportive relationship with one or two mentors throughout their initial years at UBC." Goals of the program include:

- assisting junior faculty members in the management and progression of their academic careers;
- providing a forum for sharing wisdom and experience among faculty members;
- facilitating a team approach to successful development of junior faculty; and
- developing skills in junior faculty to enable them to become future mentors.

Source: UBC, 2008.

Mentorship and Sponsorship in the Private Sector

An abundance of literature exists on mentorship initiatives in the private sector. In her survey of 393 Canadian women executives, researcher Barbara Orser (2000) found that in addition to being ranked as the most effective program for advancing women's careers, mentorship initiatives were present in a majority (70.6 per cent) of the respondents' organizations. In the U.S., the 2004 meta-analysis of mentorship in organizations by Allen *et al.* found that both male and female protégés reported more positive career outcomes, as well as higher levels of commitment and job satisfaction, than did their non-mentored counterparts.

While both psychosocial (Lockwood, 2006) and career mentoring are important for women's career satisfaction and advancement, sponsorship as a component of career mentoring has been identified as particularly effective for generating positive career results (Catalyst, 2010). Sponsors are generally senior-level individuals who use their position to help others gain access to projects and enhance their visibility within organizations (Catalyst, 2010). In other words, sponsors go beyond providing feedback and advice, and use their influence to positively affect the career advancement of their protégés through advocacy (Ibarra *et al.*, 2010). However, while an international study of 4,000 MBA alumni yielded the results

that women are generally mentored at similar rates as men (Carter & Silva, 2010), women are not sponsored in the same way as men (Ibarra *et al.*, 2010). This has clear implications for women's career futures.

The Panel noted that while important for improving the experience of individual women, mentorship does not address systemic barriers. An array of illustrative practices is necessary to address individual as well as institutional barriers. In addition, women are in the minority in PCEM departments across Canada and, indeed, at the full professor level across disciplines. Drawing exclusively from this limited pool can create difficulties not only for potential protégés who wish to forge a relationship with a female mentor, but also for senior women researchers who risk being diverted from their own careers due to the associated time commitments of mentoring several protégés (Orser *et al.*, 2012; Leck *et al.*, 2009). In addition, research in the context of the U.S. science, technology, mathematics, and engineering environment indicates that women tend to prefer relationships that occur naturally, as opposed to formal mentorship initiatives (Hill *et al.*, 2010). The paradox is that other studies highlight the dearth of natural mentorship opportunities for women, arguing that "formalized mentoring opportunities may provide, to those that do not conform to the implicit academic 'norm' — women, minority groups — the kind of in-built support that most men get inadvertently through informal relationships" (Caprile & Vallès, 2010). Although Canadian research has found that women tend to be mentored by other women (Leck & Orser, n.d.) and prefer same-sex mentorship (Lockwood, 2006), it is worth noting that these arrangements do not necessarily need to be woman to woman; women can be mentors to men, and vice versa.[70] However, the Panel did identify a challenge with this type of connection, in that relationships that transcend gender barriers are not always perceived as purely professional (Hurley & Fagenson-Eland, 1996; see also Leck *et al.*, 2009).

Similar to mentorship, peer support and knowledge sharing via networks also appears to be an important strategy for women in fields in which they are underrepresented. Organizations such as the Canadian Coalition of Women in Engineering, Science, Trades and Technology (CCWESTT) represent several groups across the country that are working to promote women in science and engineering. Examples include Actua (Ontario), the Society for Canadian Women in Science and Technology (British Columbia), the Hypatia Association (Nova Scotia), and Women in Scholarship, Engineering, Science and Technology (Alberta). Please see Chapter 6 for more information on networking.

70 Evidence regarding the efficacy of same-sex dyads versus cross-sex dyads is mixed.

Box 5.12

Promoting Women: Canadian Coalition of Women in Engineering, Science, Trades and Technology (CCWESTT)

Established in 1987, CCWESTT represents more than 20,000 individuals in 25 organizations. Its purpose is to "unite the voices of women in SETT (science, engineering, trades, and technology) across the country," and enhance the educational, professional, and vocational experiences of girls and women. Other objectives include:

"to develop and maintain a resource and support network to facilitate the exchange of information among member organizations (biannual conferences); to promote and advocate for the full participation of women in science, engineering, trades, and technology in government, business, industry, and education; and to research, measure, evaluate, and disseminate information on the integration of women in science, engineering, trades, and technology at all levels."

One of its projects, WinSETT, is being developed with the goal of increasing the hiring, improving the retention, and enhancing the work environments of women in SETT.

Source: CCWESTT, 2008.

6

The Paid Work-Family Life Balance

- Family Responsibilities and Career Trajectories
- The "Second Shift" and Unpaid Labour
- Spousal Hiring
- A Changing System?

6 The Paid Work-Family Life Balance

Chapter Key Messages

- While the decision to start a family has profound effects on the lives of women and men, the demands of balancing the paid work-family life balance appear to be greater for women than for men. Compared to men in academia, Canadian data indicate that academic women tend to have fewer children and American data show that academic women start their families later in life than men. In addition, women researchers with children tend to be in lower academic positions than men. This comes as little surprise, considering several studies show that women in academia spend more time on child care and other unpaid domestic labour than men. Extra investments in family responsibilities can translate into challenges for women who need to build their professional profile through conferences and networking events outside of regular working hours.
- Old models of career progression are insufficient for the diversified workforce of today. Strict requirements for attaining tenure, combined with a lack of temporary exit and re-entry points along the way, can negatively influence the career paths of women researchers who have, or wish to have children.

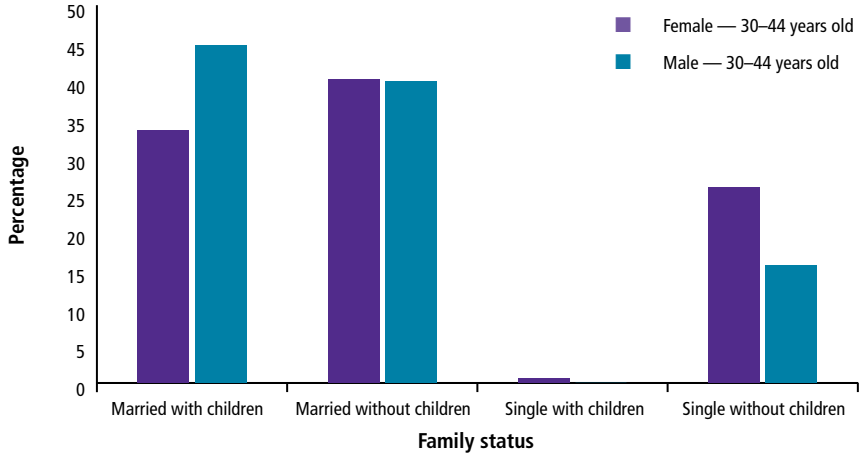
6.1 FAMILY RESPONSIBILITIES AND CAREER TRAJECTORIES

A major factor that contributes to the productivity of women researchers, and thus career trajectories, is keeping a balance between academic work and family life, including marriage or partnerships and children.[71]

The path towards becoming a full professor is long, and there exists a clear, ordered set of levels of accomplishment that academics must achieve in order to progress through their careers. After attaining an undergraduate, a master's, and a doctoral degree, potentially followed by a post-doctoral position, the next step in the academic career path is to become an assistant professor. In Canada, as of 2008, the peak age bracket for this was 35-39, for both men and women (Statistics Canada, n.d.d.). The next few years are spent in "relentless efforts to accumulate an impressive portfolio of work — encompassing research, teaching, service, and grants — until finally... a professor may be fortunate enough to earn tenure" (Williams and Ceci, 2012). The implications for women who wish to

71 The Panel was mindful of the fact that families and partnerships exist in many forms, but Canadian data did not always capture this diversity.

have children during their academic journey are clear. Canadian census data (Statistics Canada, 2006c) indicate that equal percentages of women and men academics are married without children (see Figure 6.1). However, a higher proportion of women (26 per cent) than men (16 per cent) are single without children. Conversely, a higher proportion of men (45 per cent) than women (33 per cent) are married with children. The fact that women academics in Canada do not build their families in the same way that men do is significant. As described in this chapter, this is likely a result of the challenges of balancing an academic career with a personal life — an endeavour that can be difficult for all researchers, but particularly so for women with children.



(Data Source: Statistics Canada, 2006c)

Figure 6.1

Faculty and Families in Canada

This graph shows the percentage of women and men professors from 30 to 44 years old, by family status in Canada. See Appendix 1 for further details on census data. A faculty member in this dataset is a respondent who indicated at the time of the census being a PhD holder and a university professor and working full-year, full-time in the university education industry. Children is defined as a child age five or less present in the home.

During interviews with Canadian female faculty, Carmen Armenti (2004) concluded that children, and faculty members who were mothers, tended to be perceived as a liability in the pursuit of academic goals. As a result, more established and senior women faculty were more likely to try to time childbirth for the month of May if they did not have tenure, and junior academics would try to hide their desire

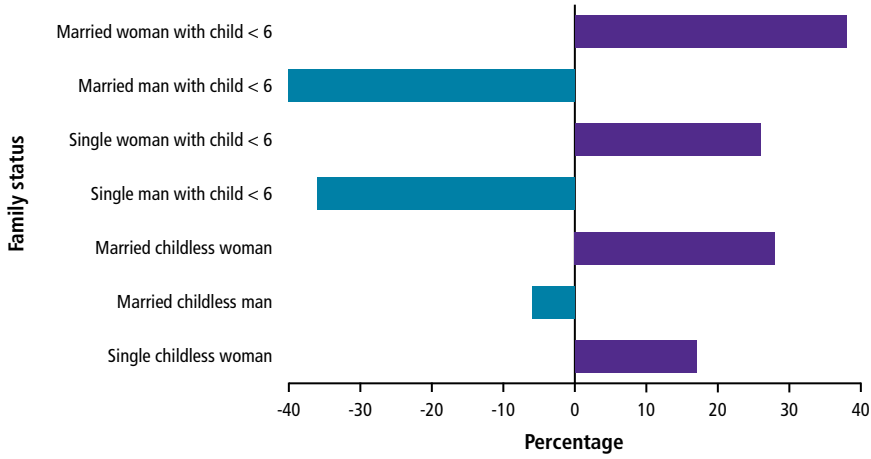
to have children until after achieving tenure. Two quotes from respondents in the Panel's secondary analysis of Canada Research Chairs data were particularly illuminating in terms of the way that pregnancy can be viewed as a burden in academia (see Box 6.1).

Box 6.1
Perceptions of Parental Leave

In terms of how parenting and academia can be perceived, one respondent in the Panel's secondary analysis of Canada Research Chairs data noted that she has heard comments from male and female colleagues to the effect of, "She's always going on mat leave," among other disparaging remarks. "It's meant to reflect how stressful the job is, how academic life is to be your only life," she stated. "Your CV is your only accomplishment." Another respondent observed that some researchers may be reticent to hire women in their labs "for fear that the renewal of their CRC would be at risk" due to a potential reduction in productivity that hiring a woman would cause, compared to her or his peers in the case of pregnancies and maternal leaves among lab staff. She or he noted that, "It is important to appreciate that this specific barrier applies not only to women but also to men who hold a CRC. At the level of the laboratory of a CRC holder, however, this barrier affects primarily young women."

These trends are not uniquely Canadian. At the University of California (UC) in the U.S., Mason and Goulden (2004) discovered that women on tenure track are more likely than at other times during their lives to give birth at the age of 36 to 40 years, whereas UC faculty men tend to have children when they are between the ages of 22 to 36. In addition, from six years prior to more than 20 years after an assistant professor hire date, UC faculty men are more likely than women to have children. Because of the lack of flexibility within the academic system, women researchers appear to be changing their life courses to fit the institutional structure, whereas men do not appear to be constrained by these considerations in the same way.

The rank of the research position that women and men are likely to have also varies, whether or not they have children. In the U.S., Wolfinger *et al.* (2009) examined the relationship between adjunct professorship[72] and with having young children. Based on the statistically-significant interaction between gender and the presence of a young child, they found that women with young children are disproportionately more likely to hold an adjunct position than men with young children (Figure 6.2). Wolfinger *et al.* (2009) conclude that for men, having young children means that they will be likely to seek lucrative and potentially secure employment, whereas women with young children tend to work in more flexible, yet lower status, positions.



(Reproduced from Wolfinger *et al.*, 2008)

Figure 6.2

The Odds of Having an Adjunct Position Rather than a Tenure Track Job in the United States

This figure depicts the gendered odds of having an adjunct position rather than a tenure track job. This is relative to the situation of a single, childless man in the United States.

Results for marriage are not statistically significant

Similarly, analyses from the Survey of Doctorate Recipients in the United States indicate that for each year after earning a PhD, married men with children under age six are 50 per cent more likely than married women with children under age

72 Not tenured or tenure-track (Wolfinger *et al.*, 2009).

six to enter a tenure track position (Frasch *et al.*, 2007, 2009). Considering many women academics who have children within five years of obtaining their PhD leave academia before obtaining their first tenure-track job (Frasch *et al.*, 2007), women in the early post-graduate environment appear to be particularly affected by institutional expectations in terms of productivity and requirements for career advancement, as well as by the demands of pregnancy, childbirth and parental responsibilities. Sonnert and Holton (1996) sum up the challenge with a time-based analogy, pointing out that women in academia face "the dilemma of synchronizing the often-conflicting demands of three clocks: the biological clock, the career clock (as in timetables for tenure), and a spouse's career clock." It appears that for many women, the decision to have children is often delayed due to the linear tenure track — without sufficient re-entry points — that is inherent within the academic promotion system.

Box 6.2
International Family-Friendly Policy Response: German Research Foundation (Deutsche Forschungsgemeinschaft, DFG)

In an attempt to address gender inequality in the sciences, the DFG established a set of research-oriented standards in 2007 that academic institutions had to implement in order to qualify for funding. The foundation made modifications to the funding scheme including providing funding for substitutes during a stipend-holder's maternity or paternity leave, allowing stipends to be used on a part-time basis, automatically extending fellowships by three months for maternity leave after delivery, and allowing stipend-holders to ask for child care support.

Source: Schiebinger, *et al.*, 2011; see also Deutsche Forschungsgemeinschaft, 2008.

Child Care

Thirty-two of the 161 respondents in the Panel's secondary analysis of Canada Research Chairs data indicated that family or community responsibilities functioned as a barrier for women researchers, making this the second most commonly identified

barrier (after barriers related to social capital and social schemas). Within this category, three themes emerged: family and child care responsibilities, parental leave, and mobility factors (see Appendix 5 for an expanded discussion of this category). One respondent stated, "For women, the years of doctoral studies and early career development coincide with childbearing years, so women with children are less likely to have been able to focus on their careers in the way that would attract CRC attention." Another responded, "Women who wish to have children are held back from a 'normal' pace of career research funding advancement at a crucial stage in their careers. These delays, for many, are somehow never regained later." Additional data from interviews suggested that some female (and some male) faculty members feel that to be taken seriously, one must be willing to forgo a satisfactory personal or family life (Appendix 5).

These quotes are illustrative of another barrier that the Panel identified: the absence of a comprehensive national child care program, which the *Report of the Royal Commission on the Status of Women* recommended over 40 years ago. The province of Quebec offers early childhood education and care for children up to four years old, at a cost of just $7 per day (Fortin *et al.*, 2011). Full-day kindergarten is also available in Quebec, as are before and after-school programs for children aged 5–12 (also at a rate of $7 per day) (Fortin *et al.*, 2011). Although wait times due to lack of space availability have been a problem, child care options in Quebec are more comprehensive than they are in other Canadian provinces, which have no such similar agreements. Waiting lists of 1,600 parents at the University of British Columbia's Childcare Services (Millar, 2010), translating into wait times of six months to three years (UBC, n.d.a.), have prompted individuals such as Associate Vice President of Human Resources Lisa Castle of UBC to explain in a *University Affairs* article: "One of the most significant issues I am told about, repeatedly, is that child care is an important determinant in whether they (faculty) join or stay at UBC" (Millar, 2010). With two- to four-year waiting lists for a child care space at Canadian universities considered the norm (Millar, 2010), costly fees (e.g., $1,975 per month for infants at the University of Toronto's Early Learning Centre) (U of T, 2011), and hours of operation that assume regular working schedules, the Panel noted that the current system is insufficient and frustrating to academic parents. On-campus child care is an important practice to help faculty members manage the paid work-family life balance, as illustrated in Box 6.3.

Box 6.3
International Institutional Response: Child Care Services at University of Konstanz, Germany

In 2007, the University of Konstanz initiated a program called *Science Goes Family* that assists the work-life balance for researchers of both genders. The program consists of four modules, with options such as flexible child care at the university, holiday care for school children, flexible working conditions for parents, grants for travel expenses for accompanying children, partners, and babysitters at conferences, stipends for doctoral and post-doctoral students with children, and information sessions on how to apply for child benefits and institutional support (U of K, 2011).

Since 2007, the percentage of women who earned a doctoral degree from the university increased from 32 per cent to 36 per cent, the proportion of female junior professors increased from 12 to 30 per cent, and women's share of senior professorships increased from 16 per cent to 18 per cent. Forty-seven per cent of the University of Konstanz's employees are women, as are 36 per cent of staff engaged in research and development. In addition, 36 per cent of the top positions at this university are held by women (GENDERA, 2010).

Networking and Travel Funds

The position of women academics who are also mothers indicates the importance of recognizing the challenges of the paid work-family life balance, in order to enable women researchers to fulfill their potential. As a Canada Research Chairs respondent to Grant and Drakich's 2011 analysis of the different experiences of male and female Canada Research Chairholders explained:

> "I understand networking and I appreciate it. I don't mind meeting other researchers and trying to make links with universities. I'm connected to [a] community and I believe in collaboration. Part of it is you go to parties, or you go to openings, or you go to book launches, and that's important. But I can't actually do 90 per cent of that because I want to be home at night. I don't get home until 7:00 every night…"

Collaboration and networking are increasingly becoming more prominent features of the research landscape. With the increasing emphasis on collaboration among diverse networks of researchers by the three granting agencies (SSHRC, NSERC, and CIHR),[73] non-governmental organizations such as Genome Canada's GE3LS[74] and the Heart and Stroke Foundation Research Fund (2005),[75] as well as the private sector, social capital — particularly network formation — is now more critical to a young researcher's career trajectory. As more interdisciplinary collaboration is required to address some of Canada's social and scientific challenges, a researcher's capacity to tap into different networks becomes more important with career advancement, for building intellectual capital and mentoring, for increasing access to funds, and later, to form and lead such networks around their research agendas. However, women do not always have the same levels of access to, or rates of participation in, these important research networks (Rhoten & Pfirman, 2007) due to the fact that they can be based on "informal relations" or male-dominated networks (Cacace, 2009) and because of family responsibilities.

Box 6.4
Parenting and Productivity

"As the mother of two children, I have had less time and ability to participate in research that requires travel. This has reduced my output in meaningful ways. While this does not constitute a formal barrier *per se*, it does illustrate the general point about how women, and more particularly mothers fare in academic life."

Opinion of respondent in the Panel's secondary analysis of barriers that affect women researchers.

73 Examples of such collaborative grants are the Partnership Development Grants (SSHRC), the Tri-Agency Partnership on Knowledge Syntheses on the Environment, the College-University Idea to Innovation Grants (NSERC), and the Collaborative Health Research Projects Program (CIHR and NSERC).

74 Genomics-related Ethical Environmental, Economic, Legal and Social Research. See Genome Canada's GE3LS webpage for more details on the interdisciplinary nature of this program: http://www.genomecanada.ca/en/ge3ls/

75 See the Heart and Stroke Research Fund's mandate at: www.hsf.ca/research/sites/default/files/HSF_Research_Fund_05.pdf

Parental responsibilities can affect many of the parameters used to assess research productivity for tenure or promotion. They include activities that occur in the evenings or out of town, such as visiting professorships, attendance at national or international symposia or workshops, invited lectures, organization of conferences, and membership on committees. Participation in these types of activities may help in establishing collaborations, publishing papers, and networking.

To help facilitate women's inclusion in research networks, conferences, and speaking engagements, Frasch *et al.*, (2007) suggested that departmental or university travel funds should be made available for faculty who want to bring their children with them to symposia or research trips. In Canada, SSHRC's *Grant Holder's Guide* indicates that only nursing mothers or single parents may claim the cost of child care expenses while they are travelling for workshops or conferences. For a single parent, the allowable cost is restricted to overnight child care costs (SSHRC, 2011a). While family-friendly travel funds are important, these caveats are problematic for families with young adopted children, or for parents who both work long hours. In comparison, Brown University in the United States offers a Dependent Care Travel Fund, which offers up to $750 per year to assist faculty members with expenses related to professional travel, including child care while at a conference, bringing a caregiver to conferences or on research trips, or extra help at home (Brown University, n.d.). Similarly, the Association of American Geographers offers a Childcare Subsidy Program for parents who attend the Association's Annual General Meeting. Each family is entitled to $300 to cover on-site child care costs, through licensed providers (AAG, 2012). Clearly, there are ways in which organizations can encourage research networking and facilitate the paid work-family life balance.

Stopping the Tenure Clock and Reducing Workloads

Stop the Tenure Clock (STC) policies, which are included in several collective agreements across Canadian universities, enable tenure-track faculty to delay their tenure reviews due to family responsibilities (such as childbirth or adoption) or illness. While this represents a positive factor that affects women researchers' career trajectories, the Panel identified a limitation in that these provisions are not always available to fathers, making it difficult for couples to share parenting responsibilities. In addition, Panel Members raised the point that in some cases, faculty on parental leave may be using some of their time to research and write, thereby elevating expectations about productivity while on leave. In a survey of Chairs and full-time faculty from 180 economics departments at Canadian and U.S. universities, Thornton (2008) found that, while the majority of women and men indicated that STC policies were helpful, only about 55 per cent of all eligible faculty used them. This finding, she notes, represents an avenue for

further exploration. In addition, she discovered that less than half of tenure review committee members have clear instructions on how to account for stopped tenure clocks in their evaluation of candidates. She concluded that STC policies are a practical family-friendly policy that particularly benefit women, but that departments need to ensure that all faculty, especially those sitting on tenure and promotion committees, clearly understand how the policy works in order for it to be effective. Institutional will is a precursor to this action. Others, such as Lenore Fahrig of Carleton University, argue that the tenure clock never really stops, and that academics feel the pressure "to stay on top of it, to stay in it." (Eisenkraft, 2004a). This may be part of the answer behind Thornton's finding of low uptake rates. As a result, reduced or modified workloads are another option for new parents, on which some Canadian universities have policies, (e.g., UWO 2010) and for which organizations such as the American Association of University Professors are advocates (AAUP, 2001).

On a similar note that is consistent with Thornton's findings, panellists noted that the practice of educating academic committee members about parental leaves could be extended to selection committee members within granting councils. These individuals could be trained to review records of scholarly accomplishment in a manner that allows them to fairly assess the productivity of grant applicants who have taken parental leave against candidates who have not.

6.2 THE "SECOND SHIFT" AND UNPAID LABOUR

The unequal division of unpaid domestic work also limits the amount of time women are able to dedicate to their research. Mason, *et al.*, (2004) looked at the self-reported hours per week spent by female and male faculty members at the University of California, with and without children, doing professional work, housework, and caregiving (Table 6.1). Women with children dedicated the most time to caregiving and housework (a total of about 50 hours per week), and spent the least amount of time on professional work (51 hours per week), while men with children spent only about 32 hours per week on domestic duties. As a result, women with children worked more hours in total than any other group, at about 101 hours per week, compared to about 88 hours per week for men with children. Although parenting can be a life-changing experience for women and men, and the division of labour can vary between households, the demands of caregiving appear to be much more onerous for women than men.

Similarly, based on data from 1,222 tenured and tenure track faculty at 13 leading research universities from across the United States, Shiebinger and Gilmartin (2010) found that female scientists do almost twice as much housework (54 per cent) as

Table 6.1

Self-reported Hours per Week Engaged in Professional Work, Housework, and Caregiving by University of California Faculty, aged 30 to 50 years

	Total hours per week			
	Professional	Housework	Caregiving	N
Women with children	51.2	14.6	35.5	338
Men with children	55.6	11.9	20.3	701
Women without children	59.8	10.6	8.1	248
Men without children	59.1	10.6	8.6	505

(Adapted and reproduced with permission from Mary Ann Mason. From Mason, *et al.*, 2004)

their male counterparts (28 per cent), and take on a disproportionate amount of child and elder care (54 per cent versus 36 per cent for males). Surprisingly, their data showed little generational variation, indicating that cultural norms are slow to change, even in highly educated households. The extra hours that women put in during the "second shift" (Hochschild & Machung, 2003) can have negative career consequences (Schiebinger & Gilmartin, 2010). Strategies that institutions can implement to assist families with the work-life balance and increase productivity include extending benefits programs to cover assistance with domestic labour (as companies such as Sony Ericsson in Sweden do), and offering flexible benefits packages which could be used for housecleaning, child care or elder care, depending on the recipient's needs (Schiebinger & Gilmartin, 2010).

Box 6.5

Family-Friendly Policy Response: The University of Toronto's Family Care Office (FCO)

Family care offices exist at several Canadian universities. With a mandate to support students, staff, faculty, and their families, the University of Toronto FCO provides guidance, referrals, and advocacy on any family care issue. It provides information about campus child care services, advice regarding family leave, counselling services, and information for students who are also parents. The FCO emphasizes an inclusive definition of family, and is committed to providing culturally sensitive service. It also aims to raise awareness of family care issues and quality of life issues that are central to the achievement of educational equity and employment equity.

Source: University of Toronto, n.d.

6.3 SPOUSAL HIRING

As described in *Dual Career Academic Couples: What Universities Need to Know*, increasing faculty diversity requires the re-examination of old models and the implementation of new institutional practices, including couple hiring (Schiebinger, *et al.*, 2008).[76] In a *University Affairs* article, Janice Drakich of the University of Windsor noted that the underrepresentation of women in universities could be at least partially addressed by spousal hiring policies. Increases in the number of academic couples, combined with a tight job market, highlight the importance of this issue, which has been developing since the late 1990s (Eisenkraft, 2004b). As Jan Nolan of the University of Toronto recalls, "if we wanted faculty members to come to our university, to settle here and be productive, we'd have to take into account their personal circumstances" (in Eisenkraft 2004b).

Critics such as Gillian Wu, Dean of Science and Engineering at York University, argue that spousal appointments can compromise the integrity of open hiring practices, but others, such as Adel Sedra, Dean of the University of Waterloo's

Box 6.6
Canadian Family-Friendly Policy Response: Spousal Appointments

As part of McGill University's "sustained effort to attract and retain highly qualified academic staff in an increasingly competitive and international environment," the university offers relocation assistance to the spouses of new faculty (McGill, 2012). In addition to tenure-track jobs, McGill offers tenured positions, contract-based positions, and non-academic positions, based on the merit of the potential spousal hire and the needs of the receiving unit. For the first six years of a spousal appointment, costs are shared between the department of the original hire, the department of the spousal hire and the Office of the Provost. After six years, the department of the spousal hire assumes full financial responsibility for appointment (McGill, 2012). By making spousal hires financially attractive to departments, qualified academic couples are able to continue their careers at the same institution.

76 While sometimes referred to as "spousal hiring," the Panel recognizes that these opportunities should be available to married, partnered, and same sex couples.

Department of Engineering, point out that the "two-body problem" can be seen as the "two-body opportunity" to attract qualified faculty. In the U.S., about 40 per cent of full-time faculty have academic partners, and 20 per cent of all universities have dual-career policies (Eisenkraft, 2004b). A variety of policies and practices have been developed in Canadian universities, from positions against spousal hires (York University), to ad hoc policies (handling appointments on a case-by-case basis, such as at the University of British Columbia), limited term appointments (at Queen's University, spousal appointments are described in the collective agreement as non-renewable term appointments for a maximum of five years, during or after which the candidate may apply for tenure) or tenured or tenure-track positions. The University of Alberta, Dalhousie University, and Carleton University, for example, have amended their collective agreements to offer tenure track jobs to spousal hires. At Carleton University, spousal appointments must be reported to the faculty association and approved by the president (Eisenkraft, 2004b). In *The Two-Body Problem*, Wolf-Wendel *et al.* (2003) found options that can facilitate the lives of dual-career academic couples. They include the joint advertising of positions (which is important for faculty recruitment, especially for small institutions), relocation assistance, offering on-campus administrative positions, promoting joint, split, or shared positions, and ensuring that transparency (on behalf of individuals and departments) is a central part of any discussion regarding tenure-track positions for spousal hires.

The positive implications of spousal hiring practices and for women's career trajectories are clear when we consider that women academics are often married to other academics (Schiebinger *et al.*, 2008), and regularly make compromises regarding the location of training and employment, which may lead to suboptimal career experiences. However, the issue is complex. Even with flexible institutional policies, the Panel noted that departments vary in terms of their capacity to fund faculty appointments. The gender dynamics of spousal hiring are also unclear: the Panel did not have data that indicate the gender of co-hires. More studies are needed to illuminate dual-hiring issues and evaluate hiring policies.

6.4 A CHANGING SYSTEM?

In response to these challenges, some researchers (Wolfinger *et al.*, 2009; Wolf-Wendel *et al.*, 2003; Mason & Goulden, 2004; Williams & Ceci, 2012) argue the need for a new way to look at academic life. To accommodate diversity on the professoriate, Wolfinger *et al.*(2009) and Wolf-Wendel *et al.* (2003) propose the creation of more adjunct positions that offer longer contracts for security, stability, and access to internal research support; part-time tenure-track positions; and "re-entry" post-doctoral fellowships that are intended to facilitate the transition of new parents back into the university. In a Toolkit for Administrators at the University of California, Frasch *et al.*, (2007) suggested that Chairs should work alongside faculty who have recently returned from parental leave to determine teaching and service arrangements that would help to facilitate their transition back into academia. Williams & Ceci (2012) summarize other options, including temporary job sharing options for couples; providing parental leaves for both parents and offering funding to facilitate re-entry; enabling parents to work from home when children are young or sick; implementing stop the tenure clock policies; offering grant extensions at no cost; extending the time available to work on grants; offering reduced workload options to new parents; implementing spousal hiring practices; providing quality on-site child care and emergency care; and ensuring fairness when hiring committees encounter applicants with career gaps. Evidence from organizational behaviour literature indicates that by implementing initiatives that promote flexibility and balance, employees may experience reduced strain from work-life conflicts (Byron, 2005), improved attitudes toward the employer (Allen, 2001; Cook, 2009; Muse *et al.*, 2008), and enhanced productivity and performance on the job (Eaton, 2003; Gajendran & Harrison, 2007).

As Donna Lero of the University of Guelph's Centre for Families, Work and Well-Being notes, family-friendly policies at universities benefit academics as well as the next generation of citizens: "The [old] model boxes in men as well as women. If we want to have excellent people who are good teachers, sensitive and supportive of their students, they need to be more than uni-dimensional. They need to have an outside life" (in Eisenkraft, 2004a). Society has shifted since the days when men were the exclusive breadwinners in households. Models that cater to male workers as the norm, are no longer effective given the advent of a diversifying workforce. The face of academia is changing, and institutions can adapt to this new diversity or continue to lose talented researchers (see Box 8.1, Misperception #5).

7

Women Researchers in Government and Industry

- Factors that Affect the Career Trajectories of Women Researchers Outside of Academia
- Organizational Culture and Leadership
- The Role of Government Policies and Legislation

7 Women Researchers in Government and Industry

Chapter Key Messages

- While there are challenges and issues facing women at the senior and executive levels outside of academia, there is very little evidence that relates specifically to researchers.
- For women in the private sector, similarities to women's experiences in academia can include career challenges related to self-confidence, performance expectations, and lack of social capital or a sense of belonging. Issues pertaining to organizational leadership, workplace culture and expectations, relationship management, and the paid work-family life balance, have also been identified as barriers to women's advancement in the private sector.
- Just as there are similarities, there are also differences. Women in the private and public sectors do not face the same challenges in terms of publishing and grant applications as do women in academic research careers. In addition, while career progression outside of academia obviously requires dedication and talent, the university model of career progression is unique in terms of expectations and time requirements.
- In response to these institutional challenges for women researchers in universities and elsewhere, several policies to promote women's professional and economic advancement have been implemented in Canada (e.g., the *Employment Equity Act*) and internationally (e.g., the Republic of Korea's *Act on Fostering and Supporting Women Scientists and Technicians*).

In addition to understanding the situation of women in university research, the Panel sought evidence on the challenges facing women researchers in government, non-governmental, and private sector organizations. The purpose of this comparison was to better understand the divergences and overlaps in women researchers' experiences across sectors, what the challenges and opportunities are in each career path, and how career progression works in organizations outside of academia. This chapter investigates the status of women in different types of research careers, and describes what employers outside of academia are doing to attract, retain, and promote women researchers. The Panel contacted 14 individuals from the private sector and non-governmental organizations with survey questions in order to generate a clearer image of the research community, identify the barriers that women researchers outside of academia encounter, and to find out what type of

proactive measures Canadian organizations are taking to attract and retain women researchers. Some of the results from the five responses the Panel received are included as evidence in this chapter. In addition, the Panel contacted individuals from several central government agencies that deal with government researchers and general government employee populations, including the Federal Science and Technology Community Management Secretariat, the Treasury Board Secretariat, Human Resources and Skills Development Canada's Labour Program, Defence Research and Development Canada, and the National Research Council with the intent to seek similar information, in addition to information about specific programs such as the Federal Contractors Program. While some individuals provided the Panel with useful documents, no data regarding the numbers of women researchers employed by the Government of Canada was provided due to a lack of statistics in some cases, and, ostensibly, privacy concerns in other cases.

As a result, while there are challenges and issues facing women in general at the senior/executive levels, there is very little evidence that relates specifically to researchers. Due to the lack of data, the Panel decided to outline the challenges facing women in particular sectors (e.g., advanced technology, government, industry) and roles (entrepreneurs, corporate managers), and extrapolate from these. This is based on the assumption that the challenges identified by women leaders in these sectors are similar to the challenges experienced by women researchers in these sectors.

Data on the occupation of PhD holders inside and outside of academia is available through Statistics Canada (2006e). Although one of the principal objectives of earning a PhD is to undertake a career in research, not all graduate students follow this path. This choice to engage in an alternative career path outside of academia may be a result of personal choice (such as individuals with PhDs who are in engineering but working in the private sector), or the consequence of an unsuccessful career in academia. Note that the career paths described here are not specifically research-oriented.

As indicated in Appendix 2, Table A2.6, the highest concentration of PhD holders, male or female, are found in universities, employed as professors and assistants (Statistics Canada, 2006e — see Appendix 2 for further details). Outside of academia, management occupations were the second most common choice for both men and women, with 7,905 and 2,315 individuals respectively. Differences emerge as we go down the list in terms of career choices made by men and women with PhDs. Men tend to be employed as physical sciences professionals (rank 3), computer and information systems professionals (rank 4), and physicians, dentists, and veterinarians (rank 5). Women, on the other hand, tend to work as

psychologists, social workers, counsellors, clergy, and probation officers (rank 3), physician, dentists, and veterinarians (rank 4), and policy and program officers, researchers, and consultants (rank 5).

7.1 FACTORS THAT AFFECT THE CAREER TRAJECTORIES OF WOMEN RESEARCHERS OUTSIDE OF ACADEMIA

Orser *et al.* (2012) observed that women in Canadian advanced technology sectors experienced barriers to advancement related to individual, company and industry practices.[77] Barriers at the individual level were the most frequently mentioned category of career challenges. Largely gender-influenced, they relate to self-confidence, performance expectations, and lack of social capital or a sense of belonging. Challenges within firms were the second most frequently mentioned category, reflecting barriers that are disadvantageous to men and women, such as a lack of organizational leadership or a lack of training and resources. Orser *et al.* (2012), found that challenges at the industry level were the third most commonly identified barrier to women in her survey. These include the culture and working conditions of the advanced technology sector, such as time and travel requirements, the unequal valuation of occupational roles (with a premium placed on technical skills), and the perception that women are marginalized in these professions. Relationship management, such as hiring, teamwork, recruitment, and retention was identified as an additional challenge, as were work-life balance

Box 7.1
Canadian Private Sector Response: Lilith Professional

Lilith Professional is a Western Canadian mentorship program for women professionals in the legal, accounting, engineering, and finance professions. The program offers one-on-one mentoring where seasoned female professionals are paired with protégés for 12 months. The professionals are afforded opportunities in leadership, career development, and networking with other dynamic colleagues. LilithPro operates through a network of about 50 corporate and academic partners to help attract, retain, and promote top female talent.

Source: LilithPro, n.d.

77 While this differentiation is helpful, the Panel noted that influences cannot be considered to be confined to each of these categories. For example, corporate culture and industry culture are likely to share several similarities, and individual barriers may stem from corporate practices.

issues. Orser *et al.* (2012) found that respondents were most likely to address these challenges through individual initiatives, as opposed to via firm or industry mechanisms.

A former academic who has transitioned to a research career in the not-for-profit sector pointed out how much happier she is in her current position where she can bring to bear her varied career and multidisciplinary trajectory to her research work. She said that although she had to take a cut in remuneration, her work environment was healthier and her experience more valued (Personal Interview, September 2011).

Box 7.2
Snapshot: The Canadian Private Sector

Many private sector organizations recognize the need to retain women employees, and several strategies aimed at achieving this objective were mentioned during the course of the Panel's personal interviews with researchers and human resources professionals in the private sector (September 2011). Some respondents described their company's benefit regimes as "not very flexible," with "do as much as possible to get the work done" attitudes and no provisions for remote work, but others spoke of initiatives in their workplace to create climates that were more inviting for women. These include:

- earned day-off programs and flexible hours to promote work-life balance;
- family-friendly leave policies that enable employees to use their sick leave in the case of illness of their children or spouse;
- workshops on the topics of professionalism and respect in the workplace, highlighting harassment policies and diversity;
- regular performance reviews for evaluation and goal-setting for career advancement; and
- confidential support programs to deliver advice and encouragement to employees.

Vice President of Research and Innovation at Ryerson University, Dr. Wendy Cukier (2010), pointed out that several large companies, especially federally-regulated ones, have strategies to promote women and other minority groups.

These include bias-free recruitment strategies (such as ensuring jobs are posted and widely circulated to reach the attention of those who may otherwise be excluded by informal networks), management development programs, diversity training and mainstreaming, promoting the existence of women's networks within organizations, flexible work policies, offering child care on location, and outreach to women's industry associations and organizations on campus. She noted that progressive companies have mainstreamed diversity by integrating diversity principles throughout their organizations, "from procurement through research, design and development, customer service, government relations, communications and philanthropy" (Cukier, 2010). Alison Maitland of the Conference Board summed up her opinion on how best to integrate women into top positions: "We shouldn't be fixing the women but the system" (The Economist, 2011).

The Government of Canada's Federal Science and Technology Community Management Secretariat gave the Panel a framework document outlining the expectations and understanding on which to base promotion for researchers in the Government of Canada (FSTCMS, 2006). This document points out that promotion and career progression is based on the delivery of four outcomes: innovation, impact, recognition, and productivity (FSTCMS, 2006). Efforts to determine whether this new framework has resulted in more women researchers being hired or promoted produced little or no evidence. However, this new framework allows researchers to be promoted by demonstrating their progress in the four areas, rather than having to compete for a position in order to move to the next level.

While research careers inside and outside of academia have some shared characteristics, there are some obvious differences in terms of career development and progression. The rigid tenure track model requires academic researchers to adhere to strict timelines while applying for grants, maintaining a sufficient record of service, teaching, and conducting research, with few opportunities for re-entry from temporary departures from the track during the life course. The pressure on a researcher in academia to obtain promotion by successfully applying for grants and providing evidence of publication is not the same as for a researcher in government. As presented throughout this section, there are several good practices and innovative responses to the underrepresentation of women in research careers from governments across the globe. Canada can both learn from, and contribute to, this growing body of data.

Box 7.3
International Response from Government and Industrial Partners: Gender Equality Principles (GEP) Initiative

The GEP initiative is a program that helps companies around the world integrate measurement tools, standards, and resources that can improve gender equality in their organizations. As part of an effort to connect women's equity with corporate policies and programs, the GEP initiative incorporates human rights principles with a code of conduct focused on "empowering, advancing, and investing in women." The program specifically addresses employment and compensation, the work-life balance, management and governance, business and marketing practices, freedom from violence, civic engagement, transparency, and accountability. The program is a partnership between the San Francisco Department on the Status of Women, the Calvert Group, and Verité.

Source: Gender Equality Principles, 2010a, 2010b.

7.2 ORGANIZATIONAL CULTURE AND LEADERSHIP

Organizational culture outside of the university can also attract women into, or repel women from, research-based careers. Although the Panel received varied responses to an interview question about the way the company size affects corporate culture, one female engineer's statement stood out: "I have found that smaller organizations can be more chauvinistic, boys' club, 'cowboy firms,' [with an attitude of] 'we have always done it like this, why should we change?' The smaller firms are generally owned by a group of men who have known each other for a long time" (Personal interview, September 2011).

The lack of women in leadership positions in general is problematic. Women's underrepresentation in top corporate positions is even more pronounced than women's underrepresentation as university presidents or in legislatures across the country. In the private sector, a 2011 Catalyst census of the percentage of women holding corporate board seats at the largest companies in Canada found that women held only 14.5 per cent of board seats at Financial Post 500 companies (Mulligan-Ferry *et al.*, 2012). In addition, approximately 40 per cent of companies had no women on their boards, and only 3.6 per cent of public companies had a woman as board chair (Mulligan-Ferry *et al.*, 2012). Looking at women in senior leadership positions in Canadian learned societies, public research organizations and the Tri-Council, readers will note that the pattern is generally replicated.

In its 130-year history, only two of the 112 Presidents of the Royal Society of Canada have been women; the same goes for the Canadian Academy of Engineering, which was founded in 1987. Although its history is relatively short, the Canadian Institutes of Health Research (CIHR), which was established by an Act of Parliament in 2000, has yet to see a woman at the helm. In its entire history since its creation in 1916, the National Research Council of Canada has never been led by a woman either. SSHRC has had two women presidents (and one acting president) since 1977.[78] On a positive note, women have headed up the Royal Society of Canada (2011-2013), the Canadian Academy of Engineering (2011), and the Canadian Academy of Health Sciences (2009-2011). For the first time since its establishment in 1978, NSERC in 2012, is also headed by a woman. While recent changes such as these should be celebrated, in terms of women's representation overall, the "higher the fewer" still seems to apply across sectors.

7.3 THE ROLE OF GOVERNMENT POLICIES AND LEGISLATION

In response to social and institutional challenges experienced by women, several policies appeared in Canada, and indeed worldwide. University education is a precondition for research careers in government and industry, consequently changes in the university environment merit discussion here. As described in Chapter 1, there has been a clear shift in university demographics since the 1970s, with increases in the total student population, and of course, increasing numbers of female students in general and by discipline. Some of the events that helped to create this shift included proactive university recruitment efforts, the women's movement and the changing attitudes towards women and their place in society, and a policy climate that was conducive to legal decisions that emphasized gender equity (Frize, 2009). In the years after the Montréal Massacre, increased public discussion and the development of initiatives to promote women in engineering helped to increase women's undergraduate representation in engineering. As already presented, important legislative changes introduced in the 1970s and 1980s paved the way for women and other underrepresented groups to enter and succeed in careers outside the home. To recap, the *Report of the Royal Commission on the Status of Women* (Canada, 1970), the *Canadian Human Rights Act* (Canada, 1985), the *Canadian Charter of Rights and Freedoms* (Canada, 1982), and the *Employment Equity Act* (Canada, 1995) represent critical events in Canada's path towards formalized gender equality. While these reports and legislation are important, results are still mixed. In addition, after 40 years, several recommendations from the report of the RCSW have never been implemented.

78 Plus one women who served as Acting President for about half a year in the mid 1990s.

Box 7.4
Policy Response: Netherlands Organisation for Scientific Research (NWO)

In an attempt to increase the participation of women in the sciences, the NWO has instituted a number of systemic changes. Some of these include working towards a ratio of 40 per cent women on each of NWO's boards and committees and a re-evaluation of grant awarding procedures to ensure that researchers with care-related responsibilities will not be hindered by "inflexible requirements or unintended stereotypes" (NWO, 2012b). In addition, the organization has several programs for women, such as More Women Researchers as University Lecturers (MEERVOUD), Athena, and Aspasia. MEERVOUD encourages women in scientific postdocs to become faculty by creating part-time assistant professor positions, with the guarantee of moving into a tenured assistant professorship (NWO, 2012a). Athena supports women in the chemical sciences, and Aspasia aims to increase the number of women at the senior academic level by awarding premiums to universities that promote women researchers (NWO, 2012c).

Several countries have taken it upon themselves to address issues similar to those experienced in Canada. For example, as a result of low birth rates, an aging population, a decline in numbers of students studying science and engineering, and a largely male work force, the Republic of Korea has been experiencing a shortage of researchers. This has serious implications for a society that depends on innovation for its economic wellbeing. In response, the Government of the Republic of Korea passed the *Act on Fostering and Supporting Women Scientists and Technicians* (2002, revised 2008) to increase the number of women scientists and engineers and to improve their career opportunities. Since 2004, the government has established Basic Plans for Fostering and Supporting Women in Science every five years as a means of follow-up (Lee, 2010). Some of the specific measures and programs include online mentoring of young women studying science and engineering; providing high school girls with work experience in engineering research laboratories; selecting a few universities as leading centres for engineering education for women; implementing targets at national and governmental science and technology institutes (and some universities) to ensure that 30 per cent of their new recruits are women and that 30 per cent of promotions go to women (known as the Recruitment Target System, or RTS); providing exclusive research

funds for women scientists, especially for those returning from maternity leave; providing a child care centre at the Daedeok Research Complex in Daejeon; and funding the Institute for Supporting Women in Science and Technology, with a mission to foster female professionals in science and technology from the start of their employment to their becoming leaders in the science and technology workplace (Lee, 2010). Further, government organizations that employ more than 30 women scientists and engineers are required to designate a senior officer to be in charge of and promote the interests of women employees.

Preliminary studies indicate that these measures have resulted in some success. As with many programs, policies, and practices the Panel reviewed, more time is needed to evaluate the effectiveness of such policies. However, under the Recruitment Target System (RTS), the percentage of female recruits increased from 18.2 per cent in 2003 to 26.6 per cent in 2009, and the proportion of female research project managers increased from 6 to 14 per cent from 2003–2009 (Lee, 2010). Although the RTS in particular generated some opposition from male scientists and engineers, it has demonstrated effectiveness in increasing the percentage of women scientists. The Panel noted this opposition is illustrative of the entrenched barriers to the advancement of women in some research careers.

8

Conclusions

- Data Gaps
- Refuting Commonly Held Misperceptions
- The Statistical Profile of Women in University Research in Canada
- Responding to the Charge
- Responding to the Sub-questions
- Final Reflections

8 Conclusions

In response to the charge, the Panel used the available data plus a variety of methodological approaches to develop a baseline of information about women researchers in Canada. This chapter synthesizes the main findings that emerged from the Panel's deliberations, and contains five main components, including a presentation of the major data gaps the Panel encountered during the course of the assessment; a summary of common misperceptions about women in research careers that the Panel identified and refuted; the Panel's response to the charge and the sub-questions; and the Panel's final reflections.

8.1 DATA GAPS

The Panel was limited in its ability to analyze all assessment questions in full due to the paucity of Canadian data. A clear definition of the challenges is required in order to create solutions and achieve goals. Despite the lack of data in some areas, the Panel was able to respond effectively to the charge. However, important data gaps should be noted. These are presented in Table 8.1.

Table 8.1

Canadian Data Gaps

This table lists the data gaps identified by the Panel during the course of the assessment.

Data that were unavailable to the Panel	Importance
Longitudinal data on university researchers	These data would enable universities to follow a cohort of faculty through their career, with the purpose of identifying what barriers they encounter at different points in time.
Data on equity groups	Data on three of the four equity groups that are the target of the Federal Contractors Program are required. This includes Aboriginal peoples, persons with disabilities, and racialized minorities. Intersectional data (e.g., data that combines gender and ethnicity) are also important. These data would facilitate a better understanding of the experience of all women researchers.
Data on government researchers	Researchers are not specifically categorized in government databases. This makes it difficult to actually identify who works as a researcher. Future studies would benefit from these data so as to compare the situation of researchers in academia and government.
Gender disaggregated data on time allocation in universities	There is a need for gender disaggregated data that describe the time spent by researchers on various activities. The presence of these data would help universities to understand how faculty divide their time among teaching, research and service, and if there are differences in this between women and men.

continued on next page

Data that were unavailable to the Panel	Importance
Gender disaggregated application and performance data on post-doctoral researchers	Data on post-doctoral researchers in Canada are extremely poor. The postdoctoral stage is a critical one for researchers in several disciplines. Evidence from the United States suggests that several barriers that women researchers face may arise during this transition period.
Comprehensive qualitative data on the experience of women in university research	These data would facilitate a broader understanding of the factors that affect women in university research. This would add to the data the Panel gleaned from a subset of women affiliated with the Canada Research Chairs program.
Data on international research collaborations	These data would help to clarify women's level of involvement in international research networks. This is important considering the increasing frequency of these endeavours.

In addition, serious gaps in the federal research funding databases are listed below:

- there is an absence of a standardized vocabulary to describe research subject areas;
- there is a lack of a common tracking mechanism among the granting councils, as a result it is challenging to combine information on specific researchers that have received grants from multiple agencies;
- the absence of a shared database makes it challenging to bring together the grants received by a researcher from more than one agency; and,
- it is difficult to indicate which researcher(s) are/were the intended beneficiaries of grants because some are provided to institutions.

Much research involves multiple researchers working together as co-investigators; however, while it is generally possible to analyze the networks and collaboration patterns among researchers, it is not possible to analyze these dynamics in terms of gender at this time.

Further, almost all research grant applications require curriculum vitae listing peer-reviewed publications and other grants received, but none of these data are available in a format that can be analyzed statistically. The Panel also noted that a more complete image of women in university research could be created if comparable institutional data on research funds from other sources (e.g., foundations and health charities) were collected. Inter-operable databases that track the funds received by specific researchers would assist with this process.

Available survey data specific to elite women researchers (e.g., Canada Research Chairs), does not capture the breadth and depth of the main issues and challenges experienced by Canadian women in university research. Ideally, the Panel would

have liked to survey female researchers; however, that was outside the scope of this assessment. Instead, the Panel relied on existing data as well as the secondary analysis of Canada Research Chairs data they commissioned.

Finally, shortly before the publication of this report, the Panel learned that Statistics Canada full-time University and College Academic Staff System (UCASS) has been discontinued. Many of the Panel's conclusions would not have been possible without these data. It will be difficult to track Canada's progress without comparable data sets in the future.

8.2 REFUTING COMMONLY HELD MISPERCEPTIONS

Taking cues from the influential 2007 NAS report, *Beyond Bias and Barriers*, the Panel assessed the validity of several commonly held misperceptions about the factors that affect the career trajectories of women researchers. As outlined in Box 8.1, an abundance of evidence refutes these misperceptions.

Box 8.1
Refuting Common Misperceptions

Misperception 1: Cognitive differences between men and women account for women's underrepresentation in research careers, especially in PCEM (physical sciences, computer science engineering and mathematics).

Response: The Panel concluded that differences in biology are insufficient to account for the low representation of tenured women professors in Canada, or their substantially lower numbers in comparison to men in the highly prestigious Canada Research Chairs and CERC positions. The issue of innate differences in women's and men's intellectual abilities is a controversial subject. However, international findings show that the variation in math performance between female versus male students is too great (e.g., across countries) to attribute to biological differences alone. Recent studies (Kane & Mertz, 2012; Else-Quest *et al.*, 2010; Hyde & Mertz, 2009) demonstrate that math achievements among girls and boys are influenced by gender equity at the national level, and that the math achievement gap between boys and girls is closing (Chapter 4).

continued on next page

Misperception 2: Time is all that is needed to increase the number of women in top research careers and fields in which they are underrepresented. We can't expect gender parity in numbers yet.

Response: Employment equity legislation was introduced in 1986 (Chapter 1). Gender parity in student enrolment was achieved on Canadian campuses over 20 years ago, and in some fields, women have earned a substantial percentage of doctoral degrees for decades. However, these increases in the source population have not translated to changes as great as one would expect at the top (Chapter 3). Barriers still exist that make it challenging for some women to break glass ceilings in academia (Chapters 4, 5, 6, and 7).

Misperception 3: Women just aren't interested in research-based careers, especially those in science and technology.

Response: Women are interested in research-based careers. In the humanities, social sciences, education, and life sciences, the percentage of women enrolled as students is equal to or greater than the percentage of men. There is a relative paucity of women only in the physical sciences, computer science, engineering and mathematics (Chapter 3). However, as opposed to "opting out" of these fields, evidence indicates that at the primary and secondary school levels, girls tend to have less self-confidence than boys in their math and science abilities, despite relatively equal performance. Insufficient knowledge about career pathways and a lack of female role models exacerbates this problem (Chapter 4). At the post-secondary and faculty level, accounts of chilly climates indicate that some women feel "pushed out" of research careers — even those at the top of their careers, and especially those in male-dominated fields (Chapter 5).

Misperception 4: Knowledge is knowledge. The gender of its creator is irrelevant.

Response: Research can be influenced by the researcher's standpoint on the issues the researcher considers to be worth investigating, the questions the researcher asks, the data the researcher considers to be worth collecting, the conclusions the researcher draws, and the value the researcher places on any given piece of research (Harding, 1991, 2004; Haraway, 1988). Contributions from diverse groups with different perspectives are important in order to address the multidimensional nature

continued on next page

of contemporary issues in some fields. Women and other traditionally marginalized groups represent a huge reservoir of untapped potential for social and scientific innovation (Chapter 2).

Misperception 5: Changing the university promotion system could have negative effects in terms of research outputs.

Response: The inflexible academic promotion system forces some researchers, especially parents of small children, to make the choice between their careers and their personal lives. Models that cater to male workers as the norm are no longer effective given the advent of a diversifying workforce. Instead of diminishing the calibre of research, re-thinking academic career paths to accommodate flexible work arrangements and family friendly policies may actually make academia a more attractive option for women and men, thereby widening the pool of qualified researchers (Chapter 6).

Misperception 6: Hiring and promotion decisions should be based on merit alone. Excellence and equity don't mix — equity programs will lower the standard.

Response: The belief that universities are meritocracies is a cherished one, but major studies continue to document systemic discrimination based on gender (Wennerås & Wold, 1997; Steinpreis *et al.*, 1999; Madera *et al.*, 2009; Lincoln *et al.*, 2012). Barriers and biases, many of them subconscious, remain factors that negatively affect the career trajectories of women researchers. Reducing these biases will promote excellence by encouraging research contributions from a range of individuals (Chapter 5).

8.3 THE STATISTICAL PROFILE OF WOMEN IN UNIVERSITY RESEARCH IN CANADA

In order to respond to the central charge, the Panel needed to develop a baseline of information regarding the statistical profile of women researchers in Canada. The Panel found that the proportion of women researchers and students in Canadian universities has increased significantly in recent decades. The Panel noted that this is an achievement to be recognized and celebrated; however, significant disparities are still present by rank and discipline. The presence of

these disparities indicates that there is still much work to be done to improve gender equity in Canadian universities. Major findings in terms of the statistical profile of women in university research in Canada include:

1. Women's progress in universities has been uneven by rank and discipline. There have been sharp increases in the proportion of female university students in Canada over the past 40 years. Gender parity among full-time students in Canadian universities was reached by 1989, and today, women represent a majority of the student population on campuses across the Canada (Figure 1.1). However, these general increases hide major differences by discipline. At the PhD level, the majority of women students are concentrated in HSE (59 per cent of all students), followed by LS (53 per cent), and PCEM (24 per cent) (Figures 3.2; 3.3; 3.4). At the faculty level, women are underrepresented across the three categories of PCEM, LS, and HSE. This is despite the fact that women and men reached parity in undergraduate student enrolment over 20 years ago. The gender disparity is particularly pronounced in PCEM, where women represent only about nine per cent of full professors in comparison to HSE (29 per cent) and LS (23 per cent) (Figures 3.4; 3.2; 3.3). The importance of attracting women to traditionally male-dominated fields before they enter university becomes clear as a challenging but crucial step towards increasing the number of women researchers in PCEM disciplines.

2. The higher the rank, the lower the percentage of women in comparison to men. The professional rank or position of women researchers is another important consideration in understanding the career trajectories of women academics. Despite increased participation in undergraduate and graduate degree programs, women are still underrepresented in senior academic and research positions, including administration. Women hold about 33 per cent of all faculty positions in Canada, of which about 43 per cent are assistant professors, 36 per cent are associate professors, and 22 per cent are full professors (Table 3.1). Women represent about 26 per cent of all Canada Research Chairs, and zero per cent of CERCs (Section 1.5). Synthetic cohort analyses indicate that while the proportion of women in professorial positions is increasing, time alone is unlikely to sufficiently address the challenge of "the higher, the fewer" (Table 3.2). Further analyses suggest that other factors (summarized below) affect the career trajectories of women researchers.

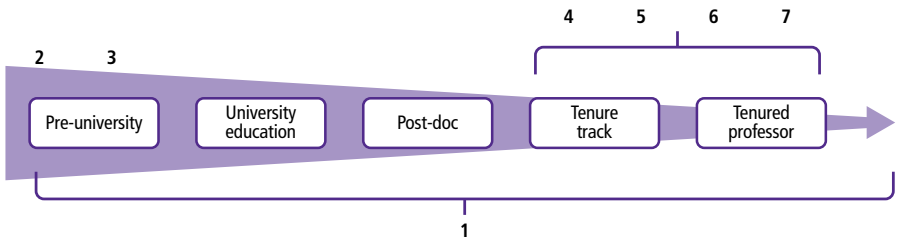
After establishing an understanding of the statistical profile of women researchers in Canada, the Panel was able to investigate the factors that contribute to the gender disparities observed in some research career trajectories.

8.4 RESPONDING TO THE CHARGE

Main Question

What policies and what societal, cultural, and institutional, economic, and/or other relevant factors influence the career trajectory of women researchers in Canadian universities and underlie gender disparities observed in Canadian university researcher's statistical profile, by discipline area, rank, duty/position/stature, salary, tenure, research funding and or/any other relevant indicators?

As presented throughout this report, the Panel reviewed and analyzed many factors, policies, and issues that affect the career trajectories of women researchers. The Panel concluded that based on the evidence, the policies, factors, and issues (influences) that are listed below emerged as those that are likely to exert the greatest effects on the career trajectories of women researchers. Every influence is linked with text boxes which contain illustrative practices from Canada and international sources, each of which aim to address these challenges. Focusing on the central part of Figure 1.4, the life course model, Figure 8.1 shows the influences that appear to the Panel to be the most relevant to the career trajectories of women researchers, and illustrates the points in time when they are most influential. Each number corresponds with a listed influence.



(Council of Canadian Academies)

Figure 8.1

Factors that Affect the Career Trajectories of Women Researchers: A Life Course Perspective

This figure is the central part of Figure 1.4. It represents the typical career path of a university researcher. The numbers refer to the factors that influence women researchers' career trajectories at different points in time, as listed in the text on the following pages.

1. Canada could be doing more to fulfill its national and international commitments to women's rights. In addition to upholding the Canadian value of equality, this would bolster Canada's capacity to engage a diverse pool of talented researchers. Canada is not meeting its own objectives in relation to gender equity goals as laid out in the *Employment Equity Act*, the *Canadian Human Rights Act* and the *UN Convention on the Elimination of All Forms of Discrimination Against Women* (CEDAW). Canada Research Chairs and CERC programs may have resulted in low numbers of women partly because of the priority areas selected by government; these priority areas (LS and PCEM) have a limited pool of women researchers. By strengthening social services that could enable parents to combine family and work responsibilities, as well as promoting more action to reduce gender stereotypes, Canada could move closer to fulfilling its commitment to the UN *Convention on the Elimination of All Forms of Discrimination Against Women*.

Box 8.2
Illustrative Practices (Governments and Research Councils)

- The Republic of Korea — *Act on Fostering and Supporting Women Scientists and Technicians*
- Sweden — *Vinnmer*
- Norway — *The Research Council of Norway (Norges forskningsråd)*
- United Kingdom — *Athena Swan Charter*
- The Netherlands — *Netherlands Organization for Scientific Research (NWO)*

2. The pathway to becoming a researcher is laid before university. Socialization, including gender schemas and stereotypes, affects decision making among adolescents. These cognitive and cultural messages that define social roles and expectations continue to operate throughout the life course. They can contribute to a lack of encouragement and support for girls to pursue non-traditional career choices, especially in PCEM disciplines. As a result, female students consistently report lower levels of self-confidence in PCEM disciplines than males do (Darisi, 2010; Singh *et al.*, 2007). This is despite studies that indicate that the math achievement gap is closing (Hyde & Mertz, 2009). New research suggests that math achievements by girls and boys are influenced by gender equity at the national level (Else-Quest *et al.*, 2010).

Box 8.3
Illustrative Practices (Universities, Schools, Governments, Advocacy Groups)

- Australia — *Women in Engineering and Information Technology (WiE&IT)*
- United States — *Center for the Study of Women, Science and Technology (WST), at the Georgia Institute of Technology*

3. Young Canadians lack sufficient knowledge about educational requirements for future careers, as well as a clear understanding of what PCEM careers entail. Evidence indicates that there is a disconnection between the educational choices some students make at the secondary level and their post-secondary or career goals. Negative perceptions of some research-based careers, a poor understanding of what these careers entail, and a lack of role models who encourage engagement with science and math, appear to be factors behind this finding. These results are particularly relevant in light of research which revealed that 75 per cent of physicists globally considered a career in physics before they entered university. Programs that have the goal of increasing student awareness about the possibilities of research-based careers early on, especially in science, engineering, and technology, were identified by the Panel as a promising practice.

Box 8.4
Illustrative Practices (Schools, Private Sector, Advocacy Groups)

- Canada — *Actua*
- Canada (Quebec) — *Academos Cybermentorat*

4. The paucity of women in leadership positions makes it difficult for other women to envision themselves as leaders. The higher one looks, the fewer women are present in comparison to men, such as in the case of full professors, and presidents of universities, leaders of government agencies, and CEOs of private sector companies. Mentorship and sponsorship initiatives provide women with role models who defy gendered expectations and offer advice and support.

Box 8.5
Illustrative Practices (Universities, Private Sector, Advocacy Groups)

- Canada (Quebec) — *Future Ingénieure?*
- Canada — *Operation Minerva*
- Canada (Manitoba) — *The Access Program Women in Science and Engineering (WISE)*

5. Institutional practices can negatively influence the career trajectories of women researchers. Despite efforts to promote equity across Canadian universities, some departments, especially those in which women are relatively scarce, have cultures that value conventional versions of "success." These self-protecting cultures can be isolating for women and others who do not "fit" the prototype of an ideal researcher.

Box 8.6
Illustrative Practices (Universities, Governments, Private Sector, Advocacy Groups)

- Canada — *Policy on Mentoring at the University of British Columbia*
- Canada — *Canadian Coalition of Women in Engineering, Science, Trades and Technology* (CCWESTT)
- Canada (Western Canada) — *Lilith Professional*
- United States — *Gender Equality Principles (GEP) Initiative*

Within institutions, the cumulative effects of sexism, stereotyping and recruitment and evaluation biases can lead to the undervaluation of women researchers' excellence — the number one finding from the Panel's re-analysis of Canada Research Chairs data. This may place women at a potential disadvantage in terms of their career progression.

Box 8.7
Illustrative Practices (Universities, Government, Advocacy Groups, Private Sector)

- United States — *Committee on Strategies and Tactics for Recruiting to Improve Diversity and Excellence (STRIDE)*
- United States — *ADVANCE*

In addition, tenure and promotion requirements often privilege research over teaching and service. However, evidence indicates that women tend to spend more time on academic service work than men. This is likely due in part to their relative scarcity in the professoriate, as well as the increasing recognition of the need for diversity on committees. Sensitivity to diversity, while being mindful of the conflicting pressures on women and other underrepresented groups, is important to recognize and address as factors contributing to the successful performance of university research.

6. For women, a small but persistent university salary gap can have significant financial effects over the long term. This salary gap cannot be fully explained by age or rank, and has changed little during recent years. Even at the full professor level, women make 95 per cent of what men do. Over years of work, this disparity contributes to a significant pay difference between women and men faculty, and can culminate in women's smaller pension payments upon retirement.

Box 8.8
Illustrative Practices (Universities, Governments, Private Sector)

- Canada — *Gender Anomalies Fund at Ryerson University*
- Canada — *Employment equity programs*

7. The paid work-family life balance is a challenge for researchers in general, but especially women researchers. Academic women tend to have fewer children, and have those children later in life, than men in academia. At the federal level, the absence of a comprehensive national child care program also makes it difficult for women who are primary caregivers to re-enter the workforce. The shortcomings of a comprehensive child care policy undermine Canada's potential in research as in much else. This affects all parents, but the effects are greater for women as there is still a well-documented unequal division of unpaid domestic work. The lock-step tenure and promotion process lacks the exit and re-entry points that are necessary for those who leave the system for periods of time to grow and care for their families. More family-friendly options and more flexible models of career progression are required to accommodate a diversifying workforce.

Box 8.9
Illustrative Practices (universities, governments, research councils, private sector)

- Canada — *University of Toronto's Family Care Office (FCO)*
- Canada — *Spousal Appointments*
- Germany — *Science Goes Family*
- Germany — *German Research Foundation (Deutsche Forschungsgemeinschaft, DFG)*

8.5 RESPONDING TO THE SUB-QUESTIONS

Sub-question #1

How does the statistical profile of women in university research careers in Canada compare to that of women in key jurisdictions abroad?

The profile of women's representation in Canadian universities is strikingly similar to that found in other economically advanced nations including the U.S., and to the average profile across the EU (Figures 3.8; 3.9). The higher the academic rank, the fewer women are present. As students, women tend to outnumber men. Their proportions equal off at the doctoral degree level, after which men outnumber women at every increasing academic rank. The Panel found that because EU statistics represent an average across the 27 member states included in this analysis, it is essential to note variations by country. Sweden, for example, has a higher percentage of female associate professors than Canada, whereas Germany has a lower percentage of associate and full professors who are women.

Sub-question #2

What are the issues that university researchers may face as they seek to advance their careers, and do these issues differ across the range of discipline areas in the natural sciences and engineering, social sciences and humanities, and health sciences? Do women researchers in government, non-governmental organizations, and the private sector face similar challenges?

This sub-question has two parts. The answer to the first part of this sub-question was presented alongside the response to the primary charge to the Panel. The second part of the sub-question is answered here.

While there are obvious differences within the models of career progression across sectors, women in the private and public sectors do not deal with the same challenges in regard to publishing imperatives, grant proposals, and the division of time among teaching, research, and service. However, there are some similarities in terms of factors that affect the career trajectories of women in other sectors, especially private industry, in terms of attitudes about what constitutes appropriate work for women, exclusive networks, narrow understandings of success, and entrenched corporate cultures that are not always amenable to diversity. Corporate culture, however, can also be a positive pull factor that helps to retain women in some fields. Organizations with strong mentorship and professional development programs, accompanied by strong codes of conduct, can clearly benefit women's career futures. While there was an abundance of evidence relating to challenges faced by women in the workforce in general, data pertaining specifically to researchers in government and the private sector were sparse.

Sub-question # 3

Both in Canada and internationally, what are the best practices adopted by universities, funding bodies, academic associations, governments, non-governmental organizations, private sector organizations, and other relevant actors to recruit and retain women researchers, and appoint them to prominent positions?

Spurred by declining birth rates, aging populations, shortages of researchers in some fields, international competition, and the quest for innovation, it is clear that countries around the world are addressing equity issues in innovative ways. Major reports and projects out of the EU, such as *Structural Change in Research Institutions: Enhancing excellence, gender equality and efficiency in research and innovation* (European Commission, 2012), and *Project GENDERA: Gender Debate in the European Research Area* (2010–2012), as well as from the U.S., such as *Beyond Bias and Barriers* (NAS, 2007) and *Why So Few* (Hill *et al.*, 2010) have examined the gender gap in academia from international perspectives. In fact, the U.S., and more recently the EU, have led the charge in terms of benchmarking and tracking the progress of women researchers. As demonstrated in Boxes 8.2 to 8.9 above, some of their member states such as Germany, Norway, the Netherlands and the U.K. have enacted strategies that Canada can look to.

Other advanced industrialized states, such as the Republic of Korea, Australia, and the U.S. are also using innovative approaches to increase the number of women researchers in fields where they are underrepresented and empower them to rise to the upper ranks of their research careers. These include programs and policies that are relevant at different points throughout the life course, starting with teaching about the many applications of science, providing information to high school students on how to achieve future educational and career goals, and providing hands-on learning experiences for girls to work alongside women researchers are also important strategies.

At the research level, good practices include programs that encourage the development of more inclusive departmental and corporate cultures, bias-free recruitment training, flexible and family-friendly university policies, and the re-examination of both the reward system and the time-sensitive tenure track model of career progression. The creation of a more flexible academic promotion system is a key aspect of this re-evaluation. Some illustrative practices also encourage gendered innovations that use sex and gender analysis as a resource to develop new knowledge (e.g., Schiebinger *et al.*, 2011 *Gendered Innovations* project). The Panel concluded that while many of the factors that affect the career trajectories of women researchers are similar internationally, there is variation in terms of the practices with which governments and universities respond. For example, the Republic of Korea recently implemented targets at national and governmental science and technology institutes (and some universities) to ensure that 30 per cent of their new recruits are women and that 30 per cent of promotions go to women. Germany's University of Konstanz offers travel funds for researchers to hire or bring babysitters with them during conferences or research trips; the STRIDE Committee at the University of Michigan created a handbook and offers workshops to administrators about mitigating evaluation biases and implementing fair hiring practices; and Australia's University of Technology, Sydney, offers mentorship and peer support programs for female students, with the goal of communicating a broader concept of engineering. Because some systems are resistant to change, there are also initiatives that aim to increase women's competitiveness within existing systems. Mentorship and targeted grants are examples of successful strategies at the individual level. However, because institutions and federal policies and practices have an impact on the career trajectories of women researchers, a systemic approach on behalf of institutions is also required to address the systemic challenges that women researchers encounter. Fixing the system, as opposed to changing women, is the best approach.

Readers are asked to bear in mind that the list of illustrative practices presented in this report is not exhaustive. Rather, these practices represent some of the ways that organizations are responding to challenges women face as they progress throughout the life course towards research careers. In addition, while each of the illustrative practices represents individual good ideas, it is important to bear in mind that "one size does not fit all" (please see Appendix 4 for more details). Responses of this nature are less effective in the context of diversifying workforces and societies. For this reason, toolkits of practices funded by dedicated budgets are stronger than isolated solutions. Further, while these practices have the potential to be reproduced, readers are reminded that responses that work in some jurisdictions may not be as effective in others due to different contexts (e.g., demographics, ideological frameworks, etc.).

8.6 FINAL REFLECTIONS

As demonstrated throughout this report, career challenges for female researchers continue across the life course. Several of the issues identified throughout the literature review were echoed by the comments from respondents in the secondary analysis of Canada Research Chairs data commissioned by the Panel. While there are many factors that can be considered deterrents to research-based careers, the attraction to academia is still strong. As Deborah Schnitzer of the University of Winnipeg reflects:

> "I am burdened both by doubt and desire. Doubts about how I have learned to survive in settings driven by competitive, hierarchical modes of analysis and conduct that I find appalling and destructive. And desire held constant by an understanding of and belief in the creative and life-giving possibility that post-secondary learning can encourage and sustain" (as quoted in Keahey & Schnitzer, 2003).

Just as there are many challenges due to the dynamic nature of the social and institutional systems that women researchers encounter throughout their life course, there are also several opportunities for progress. Within Canada and internationally, several governments, institutions and organizations are recognizing and responding to the underrepresentation of women in research positions with creative solutions to address the numerous barriers that women researchers face at different points in their lives. The conversation is growing, and good practices are emerging. The profile of Canadian women researchers has improved

during recent decades, due to changing social norms, government policies and legislation, proactive measures on the behalf of universities, and women's agency and desire to enter research careers. Much, however, remains to be done, and federal, provincial, and territorial governments have a significant role to play in levelling the playing field. Keith Louise Fulton, a former Margaret Laurence Chair in Women's Studies and retired professor of English from the University of Winnipeg, concluded optimistically:

> "We remake the university each day as we walk through the doors and take up our work there. Refusing to lay down important parts of ourselves and our communities as we enter reverses what we have been taught and reclaims ourselves and the institution" (as quoted in Keahey & Schnitzer, 2003).

Though numerous, the issues are identifiable. They have been named for many years. Women are willing and able members of the research community, but the community and its institutions must evolve if they wish to reap the real wealth of Canadian talent. By questioning tradition, and creating new models of career success and progression, Canadian women researchers will be empowered to reach their potential — to enhance creativity and innovation, to contribute to the economy, and to train the next generation of qualified researchers — for the benefit of Canadian society. Canadian governments and institutions can play a positive role in supporting women, as well as disadvantaged groups, as society promotes diversity to strengthen the research sector.

References

References

AAG (Association of American Geographers) (2012). AAG Annual Meeting: AAG's Childcare Subsidy Program. Retrieved March 20, 2012, from http://www.aag.org/cs/annualmeeting/childcare

AAUP (American Association of University Professors) (2001). Statement of Principles on Family Responsibilities and Academic Work. Retrieved March 15, 2012, from http://www.aaup.org/AAUP/pubsres/policydocs/contents/workfam-stmt.htm.

Abella, R. S. (1984). *Equality in Employment: A Royal Commission Report (General Summary)*. Toronto (ON): Commission on Equality in Employment.

Abraham, C. (2010). Part 1: Failing boys and the powder keg of sexual politics. *The Globe and Mail*. Retrieved Oct. 15, 2011 from http://www.theglobeandmail.com/news/national/time-to-lead/failing-boys/part-1-failing-boys-and-the-powder-keg-of-sexual-politics/article1758791/page2/.

Academos. (2010). Home page. Retrieved December 13, 2011, from http://www.academos.qc.ca/?lang=en/.

ACE (American Council on Education) (2007). *The American College President. 2007 Edition, 20th Anniversary*. Washington (DC): American Council on Education.

Actua. (n.d.) Home page. Retrieved January 19, 2012 from http://www.actua.ca/

Ainley, A.G. *Despite the Odds: Essays on Canadian Women and Science*. Montréal (QC): Véhicule Press.

Allen, T. D. (2001). Family-supportive work environments: the role of organizational perceptions. *Journal of Vocational Behavior*, 58(3), 414-435.

Allen, T.D., Eby, L.T., Poteet, M.L., Lentz, E., & Lima, L. (2004). Career benefits associated with mentoring for protégés: a meta-analysis. *Journal of Applied Psychology, 89*(1), 127-136.

Armenti, C. (2004). May babies and post-tenure babies: maternal decisions of women professors. *The Review of Higher Education, 27*(2), 211-231.

Ashenfelter, O., & Card, D. (2002). Did the elimination of mandatory retirement affect faculty retirement? *The American Economic Review, 92(4)*, 957-980.

AUCC (Association of Universities and Colleges of Canada) (2007). *Trends in Higher Education.* Vol 2: Faculty. Ottawa (ON): Association of Universities and Colleges of Canada.

AWSN (Alberta Women's Science Network) (2006). Operation Minerva – What is OM? Retrieved Dec. 23, 2011, from http://www.awsn.com/Minerva_Award/Operation_Minerva.html.

Backhouse, C., Henry, F., McDaniel, S., Reisz, R., Saillant, F., Sangster, J., & Strong-Boag, V. (2011). *The Royal Society for the Twenty-first Century: Report of the Task Force on Diversity*. Ottawa (ON): Royal Society of Canada.

Bakker, K., Boyd, L., Fortin, N., Johnson, J., Patch, T., Trowell, M., & Sudmant, W. (2010). *An Analysis of the Gender Pay Gap in Professorial Salaries at UBC*. Vancouver (BC): University of British Columbia.

Barker, L., & Cohoon, J. M. (2009). *Key Practices for Retaining Undergraduates in Computing*. Boulder (CO): National Center for Women & Information Technology.

Bernier, A., Larose, S., & Soucy, N. (2005). Academic mentoring in college: the interactive role of student's and mentor's interpersonal dispositions. *Research in Higher Education*, *46*(1): 29-51.

Bélanger, A., Martel, L., & Caron-Malenfant, É. (2005). *Population Projections for Canada, Provinces and Territories 2005–2031*. Statistics Canada Catalogue no. 91-520-XIE. Ottawa (ON): Statistics Canada. Retrieved January 18, 2012 from http://publications.gc.ca/Collection-R/Statcan/91-520-XIB/0010591-520-XIE.pdf.

Birker, I. (2011). Remembering Harriet Brooks: Canada's first female nuclear physicist. Retrieved January 19, 2012, from http://publications.mcgill.ca/reporter/2011/03/women%E2%80%99s-day-profile-remembering-harriet-brooks-canada%E2%80%99s-first-woman-nuclear-physicist/.

Blickenstaff, J. C. (2005). Women and science careers: leaky pipeline or gender filter? *Gender and Education*, *14*(4), 369-386.

Bondar, R. (n.d.). Physician & scientist. Retrieved January 13, 2012, from http://www.robertabondar.com/scientist.php.

Bowlby, J., & McMullen, K. (2002). *At a Crossroads: First Results for the 18 to 20-Year-Old Cohort of the Youth in Transition Survey*. Ottawa (ON): Statistics Canada and Human Resources Development Canada.

Brown University. (n.d.). Child Care. Retrieved March 14, 2012, from http://www.brown.edu/Administration/ffpf/childcare/.

Byron, K. (2005). A meta-analytic review of work-family conflict and its antecedents. *Journal of Vocational Behavior*, *67*(2), 169-198.

Cacace, M. (2009). *Guidelines for Gender Equality Programmes in Science*. Rome, Italy: European Union (PRAGES: Practising Gender Equality in Science).

Calnan, J., & Valiquette, L. (2010). *Paying Heed to the Canaries in the Coal Mine: Strategies to Attract and Retain More Women in the Engineering Profession Through Green Light Leadership*. Ottawa (ON): Engineers Canada.

Canada (1885, April 29). "The Electoral Franchise." Parliament. *Official Report of the Debates of the House of Commons of the Dominion of Canada*. 5th Parliament, 3rd session. Vol. 28 (March 27–May 8, 1885).

Canada (1970). *Royal Commission on the Status of Women*. Report. Ottawa (ON): Information Canada.

Canada (1982). *Constitution Act*. Part I: Canadian Charter of Rights and Freedoms, [c.11] C.F.R. (1982).

Canada (1985). *Canadian Human Rights Act*. R.S.C., 1985, c. H-6, C.F.R.

Canada (1995). *Employment Equity Act*. S.C. 1995, c. 44, C.F.R.

Canada (2004). *Breaking the Links Between Poverty and Violence Against Women*. National Clearinghouse on Family Violence. Prepared by Gurr, J., Pajot, M., Nobbs, D., Mailloux, L., & Archambault, D. Ottawa (ON): Public Health Agency of Canada.

Canada (2012). *Jobs, Growth and Long-term Prosperity: Economic Action Plan 2012*. Ottawa, (ON): Public Works and Government Services Canada.

Canadian Committee on Women in Engineering (1992). *More than Just Numbers, Report of the Canadian Committee on Women in Engineering*. Ottawa (ON): Department of Systems and Computer Engineering. Carleton University.

Caprile, M., & Vallès, N. (2010). *Science as a Labour Activity: Meta-analysis of Gender and Science Research — Topic Report*. Barcelona, Spain: CIREM Foundation.

Carleton University (2005). Rank of Instructor for undergraduate courses. Retrieved April 3, 2012 from http://http-server.carleton.ca/~opas/pi-2004/tables/tentaught.htm.

Carter, N. M., & Silva, C. (2010). *Mentoring: Necessary But Insufficient for Advancement*. New York (NY): Catalyst.

Catalyst (2010). *Maximizing Mentoring and Securing Sponsorship*. New York (NY): Catalyst.

CAUT (Canadian Association of University Teachers) (2005). *Almanac of Post-Secondary Education in Canada, 2005*. Ottawa (ON): CAUT.

CAUT (Canadian Association of University Teachers) (2006a) *Statement to the Labour Program of Human Resources and Social Development Canada – Regarding the 10-year Review of the Employment Equity Act*. Ottawa (ON): CAUT.

CAUT (Canadian Association of University Teachers) (2006b) Women in the academic workforce. *CAUT Education Review*. March 2006, *8*(1), Ottawa (ON): CAUT.

CAUT (Canadian Association of University Teachers) (2007). A partial picture: the representation of equity-seeking groups in Canada's universities and colleges. *CAUT Equity Review*. November 2007, *No. 1*, 1–6. Ottawa (ON): CAUT.

CAUT (Canadian Association of University Teachers) (2008). Narrowing the gender gap: Women academics in Canadian universities. *CAUT Equity Review.* March 2008, *No.* 2, 1–5. Ottawa (ON): CAUT.

CAUT (Canadian Association of University Teachers) (2009). *CAUT Almanac of Post-Secondary Education in Canada, 2008–2009.* Ottawa (ON): CAUT.

CAUT (Canadian Association of University Teachers) (2011). The persistent gap: understanding male-female salary differentials among Canadian academic staff. *CAUT Equity Review.* March 2011, No. 5, 1–8.

CAUT (Canadian Association of University Teachers) (2012). *Almanac of Post-Secondary Education in Canada, 2011–2012.* Ottawa (ON): CAUT.

CAPS (Canadian Association of Postdoctoral Scholars) (2009). Results of CAPS' Survey of Postdocs in Canada. Retrieved April 3, 2012, from http://sites.google.com/site/canadapostdoc/.

CCWESTT (Canadian Coalition of Women in Engineering, Science, Trades and Technology) (2008). CCWESTT Board — Objectives and History. Retrieved January 10, 2012, from http://www.ccwestt.org/Members/CCWESTTBoard/tabid/61/Default.aspx.

Ceci, S. J., Williams, W. M., & Barnett, S. M. (2009). Women's underrepresentation in science: sociocultural and biological considerations. *Psychological Bulletin, 135*(2), 218-261.

CERC (Canada Excellence Research Chairs) (2011a). Overview. Retrieved January 10, 2012, from http://www.cerc.gc.ca/cpov-pcap-eng.shtml.

CERC (Canada Excellence Research Chairs) (2011b). Government of Canada Launches New Competition for 10 Canada Excellence Research Chairs. Retrieved May 3, 2012 from http://www.cerc.gc.ca/releases-communiques/nr-co-20111128-b-eng.shtml.

CERC (Canada Excellence Research Chairs) (2012). Application and Nomination Process: 2012 Competition. Retrieved March 12, 2012, from http://www.cerc.gc.ca/cpan-pccs-eng.shtml.

Chaire Marianne-Mareschal. (2008). Future Ingénieure? Retrieved January 19, 2012, from http://www.chairemm.polymtl.ca/ingenieures/future_ing.php.

CHRC (Canadian Human Rights Commission). (2012). Home page. Retrieved January 11, 2012, from http://www.chrc-ccdp.ca/default-eng.aspx.

CIHR (Canadian Institute of Health Research), 2011. *Special Tabulation, Based on Application Success Rate to CIHR Research Grants & Post-Doctoral Fellowship Competition Grants from 2000 to 2011.* From CIHR unpublished raw data.

Clark, I. D., G. Moran, G., Skolnik, M. L., & Trick, D. (2009). *Academic Transformation: The Forces Reshaping Higher Education in Ontario.* Kingston (ON): Queen's University Press.

Cook, A. (2009). Connecting work — family policies to supportive work environments. *Group & Organization Management*, *34*(2), 206-240.

CRC (Canada Research Chairs) (2006). Media Release. Retrieved January 19, 2012, from http://www.unb.ca/par-l/CRC10.htm.

CRC (Canada Research Chairs) (2011a). About Us. Retrieved April 4, 2012, from http://www.chairs-chaires.gc.ca/about_us-a_notre_sujet/index-eng.aspx.

CRC (Canada Research Chairs) (2011b). Canada Research Chairs Program Announcement: Equity Target Setting Exercise and New Recognition Process for Universities. E-mail correspondence with Canada Research Chairs Secretariat.

CRC (Canada Research Chairs) (2011c). *Special Tabulation, Based on Application Success Rate to CRC Canada Research Chair Nominees from 2000 to 2010*. From CRC unpublished raw data.

CRC (Canada Research Chairs) (2012b). About Us – Program Statistics. Retrieved April 4, 2012, from http://www.chairs-chaires.gc.ca/about_us-a_notre_sujet/statistics-statistiques-eng.aspx.

CRC (Canada Research Chairs) (2012a). About Us – Governance. Retrieved May 8, 2012, from http://www.chairs-chaires.gc.ca/about_us-a_notre_sujet/governance-gouvernance-eng.aspx

Creese, M. R. S., & Creese, T. M. (1998). *Ladies in the Laboratory*. Lanham (MD): Scarecrow Press.

Crombie, G., Walsh, J. P., & Trinneer, A. (2003). Positive effects of science and technology summer camps on confidence, values, and future intentions. *Canadian Journal of Counselling*, *37*(4), 256-269.

Cross, P. (2000). *Report of the Royal Commission on the Status of Women: Where Are We After Thirty Years?* Toronto (ON): Ontario Women's Justice Network.

CSWST (The Centre for the Study of Women, Science, and Technology) (n.d.). WST Center Overview. Retrieved Jan. 19, 2012, from http://www.wst.gatech.edu/overview.html.

Cukier, W. (2010). Women in engineering: twenty years after the Montréal massacre. *The Journal of Policy Engagement*, *2*(3), 4-7.

CUSC (Canadian Undergraduate Survey Consortium) (2006). *Graduating Students Survey: Master Report*. Ottawa (ON): CUSC.

Darisi, T., Davidson, V. J., Korabik, K., & Desmarais, S. (2010). Commitment to graduate studies and careers in science and engineering: examining women's and men's experiences. *International Journal of Gender, Science and Technology*, *2*(1), 47-64.

Davidson, V. J. (2011). *Joining WiSE Conversations: Strategies & Successes from CWSE-ON 2003–2011*. Guelph (ON): Chair for Women in Science and Engineering – Ontario (CWSE-ON).

Desmarais, A. (2004). The Via Campesina: women on the fronteirs of food sovereignty. *Canadian Woman Studies/les cahiers de la femme*, *23*(1), 140-145.

Deutsche Forschungsgemeinschaft (DFG), German Research Foundation (2008). *The DFG's Research-Oriented Standards on Gender Equality* (pp. 1–6). Bonn, Germany: Deutsche Forschungsgemeinschaft (DFG), German Research Foundation.

Dey, J. G., and C. Hill. (2007). *Behind the Pay Gap*. Washington, DC: American Association of University Women Educational Foundation.

Dowdeswell, E., Fortier, S., & Samarasekera, I. (2010). *Report to the Minister of Industry of the Ad Hoc Panel on CERC Gender Issues*. Ottawa (ON): Industry Canada.

Drakich, J., & Stewart, P. (2007). Forty years later, how are university women doing? *Academic Matters* (February), 6-9.

Drolet, M. (2011). Why has the gender wage gap narrowed? *Perspectives on Labour and Income – Statistics Canada*, *23*(1), 3-13.

Dryfhout, V. L., & Estes, S. B. (2010). Explaining the gender gap in professors' intentions to leave. *Sociological Focus*, *43*(2), 109-127.

Eagly, A. H., & Carli, L. L. (2007). Women and the labyrinth of leadership. *Harvard Business Review*, *85*(9), 62.

Eagly, A. H., & Karau, S. J. (2002). Role congruity theory of prejudice toward female leaders. *Psychological Review*, *109*(3), 573-598.

Eals, M., & Silverman, I. (1994). The hunter-gatherer theory of spatial sex differences: proximate factors mediating the female advantage in recall of object arrays. *Ethology & Sociobiology*, *15*(2), 95-105.

Eaton, S. C. (2003). If you can use them: flexibility policies, organizational commitment, and perceived performance. *Industrial Relations: A Journal of Economy and Society*, *42*(2), 145-167.

ECU (Equality Challenge Unit) (2011). Chief Medical Officer links gender equality to future funding. Retrieved Nov. 15, 2011 from http://www.ecu.ac.uk/news/chief-medical-officer-links-gender-equality-to-future-funding.

Eichler, M. (1980). *The Double Standard: A Feminist Critique of Feminist Social Science*. London, United Kingdom: Croom Helm.

Eichler, M. (1987). *Nonsexist Research Methods: A Practical Guide*. Boston (MA): Allen & Unwin.

Eisenkraft, H. (2004a). In a family way. *University Affairs.* Retrieved January 15, 2012, from http://www.universityaffairs.ca/in-a-family-way.aspx

Eisenkraft, H. (2004b). Academic couples. *University Affairs*. Retrieved January 15, 2012, from http://www.universityaffairs.ca/academic-couples.aspx

Else-Quest, N. M., Hyde, J. S., & Linn, M. C. (2010). Cross-national patterns of gender differences in mathematics: a meta-analysis. *Psychological Bulletin, 136*(1), 103-127.

Elshtain, J. B. (1993). *Public Man, Private Woman: Women in Social and Political Thought.* Princeton (NJ): Princeton University Press.

Emerson, C. J. (2011). Increasing Women in SETT: *The Business Case.* St. John's (NF): Canadian Coalition of Women in Engineering, Science, Trades and Technology.

Engineers Canada (2011). *Canadian Engineers for Tomorrow: Trends in Engineering Enrolment and Degrees Awarded 2006–2010*. Ottawa (ON): Canadian Council of Professional Engineers.

Etzkowitz, H., Kemelgor, C., & Uzzi, B. (2000). *Athena Unbound: The Advancement of Women in Science and Technology*. Cambridge (MA): Cambridge University Press.

European Commission (2009). *She Figures 2009 — Statistics and Indicators on Gender Equality in Science*. Brussels, Belgium: European Commission.

European Commission (2010). *Communication from the Commission. Europe 2020: A Strategy for Smart, Sustainable and Inclusive Growth*. Brussels, Belgium: European Commission.

European Commission (2011). *Structural Change in Research Institutions: Enhancing Excellence,Gender Equality and Efficiency in Research and Innovation.* Luxembourg: Publications Office of the European Union.

Eurydice (2010). *Gender Differences in Educational Outcomes: Study on the Measures Taken and the Current Situation in Europe*. Brussels, Belgium: Education, Audiovisual and Culture Executive Agency, European Commission.

Faculty of Pharmacy and Pharmaceutical Sciences (2009). *Criteria and Procedures for Evaluations of Clinical Track Faculty*. Edmonton (AB): University of Alberta.

Faulkner, W. (2000). The power and the pleasure? A research agenda for "making gender stick" to engineers. *Science, Technology, & Human Values, 25*(1), 87-119.

Finegan, J.-A. K., Niccols, G. A., & Sitarenio, G. (1992). Relations between prenatal testosterone levels and cognitive abilities at 4 years. *Developmental Psychology, 28*(6), 1075-1089.

Fiske, S., & Taylor, S. (1991). *Social Cognition* (2nd Ed.). New York (NY): McGraw-Hill.

Fortin, P., Godbut, L., & St-Cerny, S. (2011). *Economic Consequences of Quebec's Educational Childcare Policy*. Paper presented at the Early Years Economics Forum. June 22, 2011, Toronto (ON).

Frasch, K., Mason, M.A., Stacy, A. Goulden, M. and Hoffman, C. (2007). *Creating a Family Friendly Department: Chairs and Deans Toolkit.* Oakland (CA): The University of California (UC) Family Friendly Edge.

Frasch, K., Stacy, A., Mason, M.A., Page-Medrich, S., and Goulden, M. (2009). "The devil is in the details: creating family-friendly departments for faculty at the University of California." In J. Lester & M. Sallee (Eds.), *Establishing the Family Friendly Campus: Models for Effective Practice.* Sterling (VA): Stylus.

French, E. (2001). Approaches to equity management and their relationship to women in management. *British Journal of Management, 12*(4), 267-285.

Frize, M. (2009). *The Bold and the Brave: A History of Women in Science and Engineering*. Ottawa (ON): University of Ottawa Press.

FSTCMS (Federal Science and Technology Community Management Secretariat) (2006). *Career Progression Management Framework for Federal Researchers. Application for the SE-RES Community – Key Messages*. Ottawa (ON): Federal S&T Community Management Secretariat.

Gajendran, R. A., & Harrison, D. A. (2007). The good, the bad and the unknown about telecommuting: meta-analysis of psychological mediators and individual consequences. *Journal of Applied Psychology, 92*, 1524-1541.

Gender Equality Principles (2010a). About Us. Retrieved Jan. 19, 2012, from http://www.genderprinciples.org/about.php.

Gender Equality Principles (2010b). Gender Equality Principles. Retrieved April 2, 2012, from http://www.genderprinciples.org/principles.php.

GENDERA (Gender Debate in the European Research Area) (2010). Good Practices Database: science goes family. European Commission. Retrieved April 5, 2012, from http://www.gendera.eu/index.php5?file=12&dq_id=61.

genSET (2011). *Public Consultation on the Future of Gender and Innovation in Europe: Summary Report*. London (UK): genSET.

Ghazzali, N. (2010). *The Moroccan and Canadian Experience in Promoting Science and Mathematics to Stimulate Talents in MENA (Middle Eastern and North African) Students*. Paper presented at the Building Mathematical and Scientific Talent in the BMENA Region, Amman, Jordan. Retrieved January 26, 2012 from http://www.aaas.org/programs/education/Jordan/BTC_Ghazzali_E.pdf.

Ghazzali, N., & Myrand, M.-È. (2009). *Factors Linked to the Underrepresentation of Women in Engineering*. Laval (QC): NSERC-Industrial Alliance Chair for Women in Science and Engineering in Quebec.

Gidney, R. D., & Millar, W. P. J. (1994). *Professional Gentlemen: The Professions in Nineteenth-Century Ontario*. Ontario Historical Studies Series. Toronto (ON): University of Toronto Press.

Gillett, M. E., & Sibbald, K. E. (1984). *A Fair Shake: Autobiographical Essays by McGill Women*. Montreal (QC): Eden.

Goldin, C., & Rouse, C. (2000). Orchestrating impartiality: the impact of "blind" auditions on female musicians. *The American Economic Review, 90*(4), 715-741.

Goodall, H. L. (2008). *Writing Qualitative Inquiry: Self, Stories, and Academic Life*. Walnut Creek (CA): Left Coast; Oxford: Berg [distributor].

Government of the Republic of Korea (2008). Ministry of Education, Science and Technology (Human Resources Policy Division). *Act on Fostering and Supporting Women Scientists and Technicians*. Jongno-Gu, Seoul: Republic of Korea.

Grant, K. R., & Drakich, J. (2010). The Canada Research Chairs Program: the good, the bad, and the ugly. *Higher Education, 59*(1), 21-42.

Grant, K. R., & Drakich, J. (2011). When women are equal: the Canada Research Chair experience. *Canadian Journal of Higher Education, 41*(1), 61-73.

Griffin Cohen v Her Majesty (2006). Settlement Agreement Between Marjorie Griffin Cohen, Loiuse Forsyth, Glenis Joyce, Audrey Kobayashi, Shree Mulay, Michelle Olivier, Susan Prentice and Wendy Robbins and Her Majesty the Queen in Right of Canada as Represented by the Minister of Industry. Tribunal File No. T1118/9905 C.F.R.. (2006). Retrieved from PAR-L website: http://www.unb.ca/par-l/Settlement-signed2.nov06pdf.pdf

Hall, R. M., & Sandler, B. R. (1982). *The Classroom Climate: A Chilly One for Women?* Washington (DC): Association of American Colleges.

Halpern, D. F. (2000). *Sex Differences in Cognitive Abilities* (3rd Ed.). Mahwah (NJ): L. Erlbaum Associates.

Hannah, E., Paul, L., & Vethamany-Globus, S. (2002). *Women in the Canadian Academic Tundra: Challenging the Chill*. Montreal (QC): McGill-Queen's University Press.

Haraway, D. (1988). Situated knowledges: the science question in feminism and the privilege of the partial perspectives. *Feminist Studies, 14*(3), 575-599.

Harding, S. G. (1991). *Whose Science? Whose Knowledge?* Ithaca, NY: Cornell University Press.

Harding, S. G. (2004). *The Feminist Standpoint Theory Reader: Intellectual and Political Controversies*. New York (NY): Routledge.

Hausmann, R., Tyson, L., & Zahidi, S. (2010). *The Global Gender Gap Report*. Geneva, Switzerland: World Economic Forum.

Hawkes, S. (2011). *Athena SWAN – Charter for Women in Science – Measuring Success 2011*. London, United Kingdom: Equality Challenge Unit.

Hewlett, S. A., Luce, C. B., Servon, L. J., Sherbin, L., Shiller, P., Sosnovich, E., & Sumber, K. (2008). The Athena factor: reversing the brain drain in science, engineering, and technology. *Harvard Business Review*, 1-100.

Hewstone, M., Fincham, F., & Foster, J. (2005). *Psychology*. Hoboken (NJ): Wiley-Blackwell.

Hill, C., Corbett, C., & St. Rose, A. (2010). *Why So Few? Women in Science, Technology, Engineering, and Mathematics*. Washington (DC): American Assoication of University Women.

Hochschild, A. R., & Machung, A. (2003). *The Second Shift*. New York (NY): Penguin Books.

Holzer, H. J., & Neumark, D. (2000). What does affirmative action do? *Industrial and Labor Relations Review, 53*(2), 240-271.

Hong, L., & Page, S. E. (2004). Groups of diverse problem solvers can outperform groups of high-ability problem solvers. *Proceedings of the National Academy of Sciences of the United States of America, 101*(46), 16385-16389.

HRSDC (Human Resources and Skills Development Canada) (2006). *Disability in Canada: A 2006 Profile*. Gatineau (QC): HRSDC.

HRSDC (Human Resources and Skills Development Canada) (2011). Archived — Employment Equity in Your Workplace. Federal Contractors Program — Introduction. Retrieved Jan. 12, 2012, from http://www.hrsdc.gc.ca/eng/labour/equality/fcp/employer_tool/intro/page00.shtml.

Hurley, A. E., & Fagenson-Eland, E. A. (1996). Challenges in cross-gender mentoring relationships: psychological intimacy, myths, rumours, innuendoes and sexual harassment. *Leadership & Organization Development Journal, 17*(3), 42-49.

Hutton, G., Haller, L., & Bartram, J. (2007). Global cost-benefit analysis of water supply and sanitation interventions. *Journal of Water and Health*, *5*(4), 481–502.

Hyde, J. S., & Mertz, J. E. (2009). Gender, culture, and mathematics performance. *Proceedings of the National Academy of Sciences of the United States of America (PNAS), 106*(22), 8801-8807.

Ibarra, H., Carter, N. M., & Silva, C. (2010). Why men still get more promotions than women. *Harvard Business Review*, September, 1-6.

ICTC (Information and Communications Technology Council) (2008). *Outlook for Human Resources in the Information and Communications Technology Labour Market, 2008 to 2015 — Summary Report*. Ottawa (ON): ICTC.

Industry Canada (2007). *Mobilizing Science and Technology to Canada's Advantage — Summary*. Ottawa (ON): Industry Canada. Retrieved October 10, 2011 from http://www.ic.gc.ca/eic/site/ic1.nsf/vwapj/STsummary.pdf/$file/STsummary.pdf.

Ivie, R., & Tesfaye, C. (2011). *The Global Survey of Physicists: A Collaborative Effort Illuminates the Situation of Women in Physics*. Paper presented at the 4th International Conference on Women in Physics, Stellenbosch, Western Cape, South Africa. http://www.aip.org/statistics/trends/highlite/women/global.pdf

Jacobs, J. E., & Eccles, J. S. (1992). The impact of mothers' gender role stereotypic beliefs on mothers' and children's ability perceptions. *Journal of Personality and Social Psychology, 63*(6), 932-944.

Kalev, A., Dobbin, F. & Kelly, E. L. 2006. Best practices or best guesses? Assessing the efficacy of corporate affirmative action and diversity policies. *American Sociological Review*, 71, 589-617.

Kane, J.M., & Mertz, J.E. (2002). Debunking myths about gender and mathematics performance. *Notices of the AMS, 59*(1), 10-21.

Kanter, R. M. (1977). Some effects of proportions on group life: skewed sex ratios and responses to women. *American Journal of Sociology, 82*(5), 965-990.

Keahey, D., & Schnitzer, D. (2003). *The Madwoman in the Academy: 43 Women Boldly Take on the Ivory Tower*. Calgary (AB): University of Calgary Press.

Konrad, A. M., & Linnehan, F. (1995). Formalized HRM structures: coordinating equal employment opportunity or concealing organizational practices? *Academy of Management Journal, 38*(3), 787-820.

Kram, K. E. (1985). *Mentoring at work: Developmental Relationships in Organizational Life*. Glenview (IL): Scott, Foresman and Co.

Kvande, E. (1999). "In the belly of the beast": constructing femininities in engineering organizations. *European Journal of Women's Studies, 6*(3), 305-328.

Landry, R., & Amara, N. (2001). *Estimation of Time Spent on Research in the Higher Education Sector, 2001*. Québec (QC): CHSRF/CIHR Chair on Dissemination and Uptake of Research, Department of Political Science, Université Laval.

Larose, S., Cyrenne, D., Garceau, O., Guay, F., Duclos, J.-Y., & Deschênes, C. (2010). Impacts à long terme du programme MIRES sur les trajectoires motivationnelles, scolaires et professionnelles d'adolescents intéressés par des études et carrières dans les domaines de la mathématique, des sciences et des technologies. Rapport Scientifique Intégral. *Persévérance et réussite scolaires — Phase 2*. Laval (QC): Université Laval. Retrieved March 16, 2012, from http://www.fqrsc.gouv.qc.ca/upload/editeur/RF-SimonLarose118457.pdf.

Larose, S., Cyrenne, D., Garceau, O., Harvey, M., Drouin, E., Guay, F., & Deschênes, C. (2008a). Développement et Évaluation d'un Programme de Mentorat par les pairs pour la Promotion des Études et Carrières Scientifiques (2005–2008). Laval, (QC): Université Laval.

Larose, S., Cyrenne, D., Garceau, O., Harvey, M., Guay, F., & Deschênes, C. (2008b). Personal and social support factors involved in students' decision to participate in formal academic mentoring. *Journal of Vocational Behavior, 74*(1), 108-116.

Leck, J., & Orser, B. (n.d.). An examination of gender influences in career mentoring. *Women and Enterprise Working Papers*. Ottawa (ON): Telfer School of Management, University of Ottawa.

Leck, J., Orser, B., & Riding, A. (2009). An examination of gender influences in career mentoring. *Canadian Journal of Administrative Sciences*, *26*(3), 211-229.

Leck, J. & Saunders, D. (1992). Hiring women: the effects of Canada's Employment Equity Act. *Canadian Public Policy*, *18*(2), 201-220.

Leck, J., St.-Onge, S., & Lalancette, I. (1995). Wage gap changes among organizations subject to the Employment Equity Act. *Canadian Public Policy*, *21*(4), 387-400.

Lee, K. J. B. (2010). *Effective Policies for Supporting Education and Employment for Women in Science and Technology*. Prepared for the Expert Group Meeting: Gender, science and technology. Paris, France, 28 September – 1 October, 2010. United Nations Division for the Advancement of Women (DAW, part of UN Women) and United Nations Educational, Scientific and Cultural Organization (UNESCO).

Leis-Newman, E. (2011). Securing tenure: on the tenure track? Here are four keys to making sure you get the ultimate prize. *Monitor on Psychology*, *42*(5), 76.

Levi, C. M. (2003). *Comings and Goings: University Students in Canadian Society, 1854–1973*. Montreal (QC): McGill-Queen's University Press.

Library and Archives Canada (2010). Dr. Frances Gertrude McGill. Retrieved January 19, 2012, from http://www.collectionscanada.gc.ca/women/030001-1417-e.html.

LilithPro (n.d.). About Us. Retrieved January 19, 2012, from http://www.lilithprofessional.com/about-us/index.html.

Lin, B. (2009). Profs care about teaching: UBC survey. *UBC Reports*, *55*(6), 6.

Lincoln, A. E., Pincus, S., Koster, J. B., & Leboy, P. S. (2012). The Matilda Effect in science: awards and prizes in the U.S., 1990s and 2000s. *Social Studies of Science*, *42*(2), 307-320.

Link, A. N., Swann, C. A., & Bozeman, B. (2007). A time allocation study of university faculty. *Economics of Education Review* 27*(4)*, 363-374.

Lockwood, P. (2006). "Someone like me can be successful": do college students need same-gender role models? *Psychology of Women Quarterly*, *30*(1), 36-46.

Löfström, Å. (2009). *Gender Equality, Economic Growth and Employment*. Stockholm, Sweden: Swedish Government. Retrieved September 19, 2011, from http://www.se2009.eu/polopoly_fs/1.17994!menu/standard/file/EUstudie_sidvis.pdf.

London Business School. (2007). *Innovative Potential: Men and Women in Teams*. London, United Kingdom: London Business School.

Luther, R., Whitmore, E., & Moreau, B. M. (2003). *Seen But Not Heard: Aboriginal Women and Women of Colour in the Academy* (2nd Ed.). Ottawa (ON): Canadian Research Institute for the Advancement of Women (CRIAW).

MacDonald, T. (2008). *Retaining Girls in Science: Exploring the Effects of a Junior High Intervention Program Across Educational Sectors — 2005–2007 Evaluation*. Calgary (AB): Alberta Women's Science Network (AWSN).

Madera, J. M., Hebl, M. R., & Martin, R. C. (2009). Gender and letters of recommendation for academia: agentic and communal differences. *Journal of Applied Psychology, 94*(6), 1591-1599.

Malcom, S. M., Hall, P. Q., & Brown, J. W. (1976). *The Double Bind: The Price of Being a Minority Woman in Science*. Washington (DC): American Association for the Advancement of Science (AAAS).

Mandleco, B. (2010). Women in academia: what can be done to help women achieve tenure? *Forum on Public Policy, 2010*(5), 1-3.

Margolis, J., & Fisher, A. (2002). *Unlocking the Clubhouse: Women in Computing*. Cambridge (MA): MIT Press.

Martinez, E., Botos, J., Dohoney, K., Geiman, T., Kolla, S., Olivera, A., Cohen-Fix, O. (2010, March 10–11). *Falling off the Academic Bandwagon: Why Women are More Likely to Quit at the Postdoc to Principal Investigator Transition. Findings of the NIH Postdoc Subcommittee Survey.* Paper presented at the National Summit on Gender and the Postdoctorate, Philadelphia (PA).

Mason, M. A., & Ekman, E. M. (2007). *Mothers on the Fast Track: How a New Generation Can Balance Family and Careers*. New York (NY): Oxford University Press.

Mason, M. A., & Goulden, M. (2004). Marriage and baby blues — redefining gender equity in the academy. *The ANNALS of the American Academy of Political and Social Science, 596*(1), 86-103.

Mason, M.A., Stacy, A., and Goulden, M. (2004). *Report on the University of California Faculty Work and Family Survey: Developing New Initiatives for a Family Friendly Package.* Presentation. University of California, Berkeley, Family Friendly Edge.

May, R., G. Strachan, K. Broadbent, D. Peetz. (2011). The Casual Approach to University Teaching: Time for a Re-Think? In K. Krause, M. Buckridge, C. Grimmer, and S. Purbrick-Illek (Eds.) *Research and Development in Higher Education: Reshaping Higher Education, 34* (pp. 188–197). Refereed papers from the 34th HERDSA Annual International Conference. Gold Coast, Australia, 4–7 July 2011.

McGill University (2012). Spousal employment possibilities. Retrieved March 15, 2012, from https://www.mcgill.ca/apo/administrators/deans-and-chairs-guide/spousal-employment.

McGill University Archives (2003). Carrie Derick, 1862–1941. Retrieved January, 2012, from http://www.archives.mcgill.ca/public/hist_people/derick/cderick.htm.

McKeen, W. (2004). *Money in Their Own Name: The Feminist Voice in the Poverty Debate in Canada, 1970–1995*. Toronto (ON): University of Toronto Press.

McKinsey & Company. (2008). *Women Matter 2: Female Leadership, a Competitive Edge for the Future*. Paris, France: McKinsey & Company, France.

McKenna, R., Richmond, K., Dodd, J., & Chow, D. (1990). Postgraduate experience — the great sex divide in health sciences. *New England Journal of Medicine. 323*(6), 1637-1638.

McLean, D. (2003). *Workplaces that Work: Creating a Culture that Attracts, Retains and Promotes Women*. Prepared for the Federal/Provincial/Territorial Ministers Responsible for the Status of Women. Toronto (ON): Queen's Printer for Ontario.

Millar, E. (2010). Urgent need for campus child-care spaces. Retrieved May 7, 2012, from http://www.universityaffairs.ca/urgent-need-for-campus-child-care-spaces.aspx.

Milligan, L., & Leckie, G. (2004). *Challenges of the Academic Journey: A Symposium on Women in the Sciences and Engineering at UWO*. Paper presented at the Symposium on Women in the Sciences and Engineering at UWO, May 4–5, 2004 in London (ON).

Misra, J., Lundquist, J. H., Holmes, E., & Agiomavritis, S. (2011). The ivory ceiling of service work. *Academe, 97*(1), 22-26.

MIT (Massachusetts Institute of Technology) (1999). *A Study on the Status of Women Faculty in Science at MIT*. Cambridge (MA): MIT.

MIT (Massachusetts Institute of Technology) (2011). *A Report on the Status of Women Faculty in the Schools of Science and Engineering at MIT, 2011*. Cambridge (MA): MIT.

Moore, M. E., Konrad, A. M., & Hunt, J. (2010). Creating a vision boosts the impact of top management support on the employment of workers with disabilities: The case of sport management in the USA. *Equality, Diversity and Inclusion: An International Journal, 29*(6), 609-626.

Morgan, R. (2003). Calls to action: human rights complaint concerning the Canada Research Chairs Program. Retrieved Feb. 2, 2012, from http://www.unb.ca/par-l/CRC_complaint.htm.

Mulligan-Ferry, L., Friedrich, M., & Nathanson, S. (2012). *2011 Catalyst Census: Financial Post 500 Women Board Directors*. New York (NY): Catalyst.

Munro, J. (2004). The debate about mandatory retirement in Ontario universities: Positive and personal choices about retirement at 65. *Working Paper No. 22*. Toronto (ON): Department of Economics and Institute for Policy Analysis, University of Toronto.

Munro, J. (2010). *The Question of Mandatory Retirement*. Retrieved May 7, 2012 from http://www.economics.utoronto.ca/munro5/MandatoryRetirement.htm.

Muse, L., Harris, S. G., Giles, W. F., & Feild, H. S. (2008). Work-life benefits and positive organizational behavior: is there a connection? *Journal of Organizational Behavior, 29*(2), 171-192.

NAS (National Academy of Sciences) (2007). *Beyond Bias and Barriers: Fulfilling the Potential of Women in Academic Science and Engineering*. Washington (DC): NAS.

NAS (National Academy of Sciences) (2010). *Gender Differences at Critical Transitions in the Careers of Science, Engineering, and Mathematics Faculty*. Washington (DC): NAS.

NAS (National Academy of Sciences) (2011). *A Framework for K-12 Science Education: Practices, Crosscutting Concepts, and Core Ideas*. Washington (DC): NAS.

National Advisory Board on Science and Technology (1989). *Report of the Committee on the Participation of Women in Science and Technology*. Ottawa (ON): National Advisory Board on Science and Technology.

NCES (National Center for Education Statistics) (2011). Institute of Education Sciences. *Postsecondary Awards in Science, Technology, Engineering, and Mathematics, by State: 2001 and 2009*. Web tables, NCES 2011-226. Washington (DC): U.S. Department of Education.

NRC (National Research Council) (2010). Committee on Gender Differences in the Careers of Science, Engineering, and Mathematics Faculty, Committee on Women in Science, Engineering, and Medicine. "Chapter 4 — professional activities, institutional resources, climate, and outcomes." In *Gender Differences at Critical Transitions in the Careers of Science, Engineering, and Mathematics Faculty.* Washington(DC): The National Academies Press.

NSERC (Natural Sciences and Engineering Research Council of Canada) (2010). *Women in Science and Engineering in Canada*. Ottawa (ON): Corporate Planning and Policy Directorate, NSERC.

NSERC (Natural Sciences and Engineering Research Council of Canada) (2011a). *Chairs for Women in Science and Engineering Program*. Retrieved January 19, 2012, from http://www.nserc-crsng.gc.ca/Professors-Professeurs/CFS-PCP/CWSE-CFSG_eng.asp.

NSERC (Natural Sciences and Engineering Research Council of Canada) (2011b). *Special Tabulation, based on Application success rate to NSERC Discovery Grants from 2000 to 2011*. From NSERC Unpublished raw data.

NWO (Netherlands Organisation for Scientific Research) (2012a). More Women Researchers as University Lecturers (MEERVOUD). Retrieved April 2, 2012, from http://www.nwo.nl/nwohome.nsf/pages/NWOA_4XEJPH_Eng?Opendocument.

NWO (Netherlands Organisation for Scientific Research) (2012b). Why Science Needs More Women. Retrieved April 2, 2012, from http://www.nwo.nl/nwohome.nsf/pages/NWOP_5V7DFD_Eng.

NWO (Netherlands Organisation for Scientific Research) (2012c). Special Programmes for Women. Retrieved April 2, 2012, from http://www.nwo.nl/nwohome.nsf/pages/NWOP_5V7FYQ_Eng.

OAG (Office of the Auditor General) (2009). *Spring 2009 Report of the Auditor General of Canada*. Ottawa, ON: Public Works and Government Services Canada. Retrieved from http://www.oag-bvg.gc.ca/internet/English/parl_oag_200905_01_e_32514.html.

OECD (Organisation for Economic Co-operation and Development) (OECD). (2002). *Frascati Manual: Proposed Standard Practice for Surveys on Research and Experimental Development*. Paris, France: OECD.

OECD (Organisation for Economic Co-operation and Development) (2004). *Learning for Tomorrow's World: First Results from PISA 2003*. Paris, France: OECD.

OECD (Organisation for Economic Co-operation and Development) (2006). *Women in Scientific Careers: Unleashing the Potential*. Paris, France: OECD.

OECD (Organisation for Economic Co-operation and Development) (2008). *Gender and Sustainable Development: Maximising the Economic, Social and Environmental Role of Women*. Paris, France: OECD.

OECD (Organisation for Economic Co-operation and Development) (2010). *Programme for International Student Assessment Survey. PISA 2009 Results: What Students Know and Can Do - Student Performance in Reading, Mathematics and Science* (Volume 1). Paris, France: OECD.

OISE (Ontario Institute for Studies in Education, University of Toronto) (2012). Centre for Women's Studies in Education. Retrieved May 23, 2012, from http://www.oise.utoronto.ca/cwse/index.html.

OME (Ontario Ministry of Education) (2009). Realizing the Promise of Diversity: Ontario's Equity and Inclusive Education Strategy. Toronto (ON): Queen's Printer for Ontario. Retrieved May 3, 2012, from www.edu.gov.on.ca/eng/policyfunding/equity.pdf.

Ornstein, M., Stewart, P., & Drakich, J. (2007). Promotion at Canadian universities: The intersection of gender, discipline, and institution. *Canadian Journal of Higher Education*, *37*(3), 1-25.

Orser, B. (2000). *Creating High-Performance Organizations — Leveraging Women's Leadership*. Ottawa (ON): The Conference Board of Canada.

Orser, B., Riding, A., & Stanley, J. (2012). Perceived career challenges and response strategies of women in the advanced technology sector. *Entrepreneurship & Regional Development*, *24*(1-2), 73-93.

Park, S. M. (1996). Research, Teaching, and Service: why shouldn't women's work count? *The Journal of Higher Education* (Vol. 67, pp. 46-84).

Penner, A. M. (2008). Gender differences in extreme mathematical achievement: an international perspective on biological and social factors. *American Journal of Sociology*, *114*, S138–S170.

Picard-Aitken, M., Foster, T., Labrosse, I., Caruso, J., Campbell, D., & Archambault, E. (2010). *Tenth-Year Evaluation of the Canada Research Chairs Program — Final Evaluation Report*. Montréal (QC): Science-Metrix Inc.

Powell, A., Bagilhole, B., Dainty, A., & Neale, R. (2004). Does the engineering culture in UK higher education advance women's careers? *Equal Opportunities International*, *23*(7/8), 21-38.

Queen's University (2003). History of the Faculty. Retrieved March 16, 2012, from http://www.queensu.ca/calendars/archive/2003-04/medicine/HistoryoftheFaculty_1603.htm.

Raboy, M. (1993). Crise des médias, crises de société: les femmes, les hommes et l'École Polytechnique de Montréal. *Communication*, *14*(1), 83-105.

Research Council of Norway. (2010). Innovation project for the industrial sector. Retrieved January 13, 2012, from http://www.forskningsradet.no/en/Innovation_project_for_the_industrial_sector/1253963988186.

RFA (Ryerson Faculty Association) (2012) (ratified). *RFA Collective Agreement (Extract) 2011–2015*. Article 13.5, salary anomaly adjustments committee. Toronto (ON): Ryerson Faculty Association.

Rhoten, D. & Pfirman, S. (2007). Women in interdisciplinary science: exploring preferences and consequences. *Research Policy*, *(36)*, 56-75.

Rivers, C., Barnett, R. (2011). *The Truth About Girls and Boys: Challenging Toxic Stereotypes About Our Children*. New York (NY): Columbia University Press.

Robbins, W., Luxton, M., Eichler, M., & Descarries, F. (2008). *Minds of Our Own: Inventing Feminist Scholarship and Women's Studies in Canada and Québec, 1966–76*. Waterloo (ON): Wilfrid Laurier University Press.

Robbins, W., & Ollivier, M. (2006). *Canadian Federation for the Humanities and Social Sciences — Feminist & Equity Audits 2006*. Ottawa (ON): Canadian Federation for the Humanities and Social Sciences (CFHSS).

Robbins, W., & Schipper, B. (2011). Postsecondary Pyramid. *Equity Audit, 2011*. PAR-L Policy, Action, Research List. (2010 version available online at http://www.unb.ca/PAR-L/Pyramid2010.pdf.)

Robbins, W., Sutherland, R., & Hurley, C. (2011). *Canadian Academic Women's Life-writing, or, Research Careers in Context*. Unpublished manuscript, University of New Brunswick.

Rossiter, M. W. (1993). The Matthew Matilda Effect in science. *Social Studies of Science, 23*(2), 325-341.

Royal Society of Canada (1989). *Plan for Advancement of Women in Scholarship*. Ottawa (ON): Committee for Advancement of Women in Scholarship.

Salter, A., D'Este, P., Martin, B., Geuna, A., Scott, A., Pavitt, K., Nightingale, P. (2000). *Talent, not Technology: Publicly Funded Research and Innovation in the UK*. Brighton, United Kingdom: University of Sussex.

Sandler, B. R., Silverberg, L. L., & Hall, R. M. (1996). *The Chilly Classroom Climate: A Guide to Improve the Education of Women*. Washington (DC): National Association for Women in Education.

Schaefer, A. C. (2000). *G.I. Joe meets Barbie, Software Engineer Meets Caregiver: Males and Females in B.C.'s Public Schools and Beyond — BCTF Research Report*. Vancouver (BC): B.C. Teachers' Federation.

Schiebinger, L., & Gilmartin S.K.. (2010). Housework is an academic issue. *Academe (96)* 39-44.

Schiebinger, L., Henderson, A. D., & Gilmartin, S. K. (2008). *Dual-career Academic Couples — What Universities Need to Know*. Stanford (CA): Michelle R. Clayman Institute for Gender Research, Stanford University.

Schiebinger, L., Klinge, I., Sanchez de Madariaga, I., and Schraudner, M., (Eds.) (2011). *Gendered Innovations in Science, Health & Medicine, and Engineering*. Stanford University. http://genderedinnovations.stanford.edu/.

Schiebinger, L., & Schraudner, M. (2011). Interdisciplinary approaches to achieving gendered innovations in science, medicine, and engineering. *Interdisciplinary Science Reviews, 36*(2), 154-167.

Seltzer, G. (1989). *Music Matters: The Performer and the American Federation of Musicians*. Metuchen (NJ): Scarecrow.

Shields, S. (1982). The variability hypothesis: The history of a biological model of sex differences in intelligence. *Signs*, 7(4), 769-797.

Side, K., & Robbins, W. (2007). Institutionalizing inequalities in Canadian universities: the Canada Research Chairs Program. *Journal of the National Women's Studies Association*, *19*(3), 163-181.

Singh, K., Scheckler, R., Darlington, L., & Allen, K. R. (2007). Women in computer-related majors: a critical synthesis of research and theory from 1994 to 2005. *Review of Educational Research*, 77(4), 500-533.

Smith, M. (2011). Leading on equity and diversity matters: yes we can, and yes we will! FEDCAN blog, Canadian Federation for the Humanities and Social Sciences. Retrieved January 13, 2012, from http://blog.fedcan.ca/2011/01/05/leading-on-equity-and-diversity-matters-yes-we-can-and-yes-we-will/.

Sonnert, G., & Holton, G. (1996). Career patterns of women and men in the sciences. *American Scientist*, *84*(1), 63-71.

SSHRC (Social Sciences and Humanities Research Council of Canada) (2011a). Grant Holder's Guide — Aid to research workshops and conferences. Retrieved April 2, 2012, from http://www.sshrc-crsh.gc.ca/funding-financement/using-utiliser/grant_regulations-reglement_subventions/conferences-colloques-eng.aspx.

SSHRC (Social Sciences and Humanities Research Council) (2011b). *Special Tabulation, based on Application success rate to SSHRC Standard Research Grants & SSHRC Post-doctoral fellowships Grants from 2000 to 2011*. From SSHRC Unpublished raw data.

Statistics Canada. (1986) Average and median earnings (in current dollars) of persons with a doctorate, other than university professors, who worked full-year full-time, by field of study, class of worker, sex and age group, 1986 (table). *Census, 1986*. Ottawa (ON): Statistics Canada.

Statistics Canada (2004). *Federal Scientific Activities 2003–2004*. Statistics Canada Catalogue no. 88-204-XIE. Ottawa (ON): Statistics Canada. Retrieved December 14, 2011, from http://publications.gc.ca/collections/Collection/Statcan/88-204-XIB/0000488-204-XIE.pdf.

Statistics Canada (2006a). Average and median earnings (in current dollars) of persons with a doctorate, other than university professors, who worked full-year full-time, by field of study, class of worker, sex and age group, 2006 (table). *Census, 2006*. Ottawa (ON): Statistics Canada.

Statistics Canada (2006b). Estimated number of full year-full time university professors by sex and age groups, 2006 (table). *Census, 2006*. Ottawa (ON): Statistics Canada.

Statistics Canada (2006c). Estimated number of full-year full-time university professors with children aged 5 or less present in the home, by marital status, sex and age group, 2006 (table). *Census, 2006*. Ottawa (ON): Statistics Canada.

Statistics Canada (2006d). Estimated number of university professors who were not employed full year-full time by sex and age groups, 2006 (table). *Census, 2006*. Ottawa (ON): Statistics Canada.

Statistics Canada (2006e). Estimated number of persons with a doctoral degree or degree in medicine, dentistry, veterinary medicine or optometry who were employed full year-full time, by type of degree, occupation and gender, for census year 2006. *Census, 2006*. Ottawa (ON): Statistics Canada.

Statistics Canada. (2006f). Census data products: Percentage visible minorities for Canada, provinces and territories, 1996, 2001 and 2006 censuses. Ottawa (ON): Statistics Canada. Retrieved May 31, 2011, from http://www12.statcan.gc.ca/census-recensement/2006/dp-pd/92-596/P2-2.cfm?Lang=eng&T=PR&LINE_ID=901.

Statistics Canada (2006g). Estimated number of persons with a doctorate degree, other than university professors, who worked full-year full-time, by class of worker, for census year 2006. *Census, 2006*. Ottawa (ON): Statistics Canada.

Statistics Canada. (2006h). Estimated number of persons with a doctoral degree who were inactive (not in the labour force) by attendance at school, age group and gender, for census year 2006 (table). *Census, 2006*. Ottawa (ON): Statistics Canada.

Statistics Canada (2006i). Estimated number of persons with a doctoral degree who were unemployed, by situation of unemployment, age group and gender, for census year 2006. *Census, 2006*. Ottawa (ON): Statistics Canada.

Statistics Canada (2006j). Estimated number of persons with a doctoral degree or degree in medicine, dentistry, veterinary medicine or optometry who were employed full year-full time, by type of degree, industry and gender, for census year 2006 (table). *Census, 2006.* Ottawa (ON): Statistics Canada.

Statistics Canada. (2008b). *Aboriginal Peoples in Canada in 2006: Inuit, Métis and First Nations.* Statistics Canada Catalogue no. 97-558-XIE. Census Year 2006. Ottawa (ON): Statistics Canada.

Statistics Canada (2007–08). Primary sources of financial support by gender, 2007/2008. *Survey of Earned Doctorates, 2007/2008.* Ottawa (ON): Statistics Canada.

Statistics Canada (2009). *Science Statistics — Federal Government Expenditures on Scientific Activities, 2009/2010 (Intentions) October 2009 Edition.* Statistics Canada Catalogue no. 88-001-X. Ottawa (ON): Statistics Canada. Retrieved September 13, 2011, from http://www.statcan.gc.ca/pub/88-001-x/88-001-x2009006-eng.pdf.

Statistics Canada (2010). *Gross Domestic Expenditures on Research and Development in Canada (GERD), and the Provinces — National estimates 2000 to 2010, Provincial estimates 2004–2008.* Vol 3, Statistics Canada Catalogue no. 1.88-221-X. Ottawa (ON): Statistics Canada. Retrieved December 12, 2011, from http://www.statcan.gc.ca/pub/88-221-x/88-221-x2010001-eng.pdf.

Statistics Canada (2011). Salaries and salary scales of full-time teaching staff at Canadian universities 2010/2011: final report. *Culture, Tourism and the Centre for Education Statistics: Research Papers.* Statistics Canada Catalogue no. 81-595-M. Ottawa (ON): Statistics Canada.

Statistics Canada (n.d.a). Number of staff and average and median salary by rank and gender from 1970–71 to 2008–09 in 5 year increments (starting with 1970–71, then 1975–76, 1980–81 etc.) (table). *University and College Academic Staff System (UCASS), 1970/1971 to 2008/2009.* Ottawa (ON): Statistics Canada.

Statistics Canada (n.d.b). *Postsecondary Student Information System (PSIS) (database), 1992 to 2008.* Ottawa (ON): Statistics Canada.

Statistics Canada (n.d.c). *Full-time university enrolment, by sex, Canada and provinces, selected years, 1920 to 1975 (database).* Statistics Canada Catalogue no. W340-438. Ottawa (ON): Statistics Canada.

Statistics Canada (n.d.d). University professors/researchers who hold a PhD by academic year, rank, broad subject taught, sex and age group (table). *University and College Academic Staff System (UCASS), 1970/1971 to 2008/2009*. Ottawa (ON): Statistics Canada.

Statistics Canada (n.d.e). *University Student Information System (database), 1971/1972 to 1991/1992*. Ottawa (ON): Statistics Canada.

Statistics Canada (n.d.f). University and College Academic Staff System (UCASS), 2008. Ottawa (ON): Statistics Canada.

Steinpreis, R. E., Anders, K. A., & Ritzke, D. (1999). The impact of gender on the review of the curricula vitae of job applicants and tenure candidates: a national empirical study. *Sex Roles, 41*(7/8), 509-528.

STIC (Science, Technology and Innovation Council) (2011). *State of the Nation 2010 — Canada's Science, Technology and Innovation System: Imagination to Innovation — Building Canadian Paths to Prosperity*. Ottawa (ON): Government of Canada. Retrieved November 15, 2011, from http://www.stic-csti.ca/eic/site/stic-csti.nsf/eng/h_00038.html.

Stromquist, N. (2007). The gender socialization process in schools: a cross-national comparison. Paper commissioned for the *Education for All Global Monitoring Report 2008, Education for All by 2015: Will We Make It?* Paris, France: United Nations Educational Scientific and Cultural Organization.

SWC (Status of Women Canada) (2002). *Canadian Experience in Gender Mainstreaming 2001*. SW21-97/2002. Ottawa (ON): Status of Women Canada — Gender-Based Analysis Directorate.

SWC (Status of Women Canada) (2007). *Gender-Based Analysis — An Integrated Approach to Gender-Based Analysis*. Ottawa (ON): Gender-Based Analysis Directorate.

SWC (Status of Women Canada) (2012). Who we are. Retrieved March 30, 2012, from www.swc-cfc.gc.ca/abu-ans/index-eng.html.

Symons, T. H. B., & Page, J. E. (1984). *Some Questions of Balance: Human Resources, Higher Education and Canadian Studies*. Ottawa (ON): Association of Universities and Colleges of Canada.

The Economist. (2011). Here's to the next half-century. November 26–December 2, 2011. Retrieved December 4, 2011, from http://www.economist.com/node/21539930.

Thornton, S. R. (2008). *The Implementation and Utilization of Stop the Tenure Clock Policies in Canadian and U.S. Economics Departments*. Hampden-Sydney (VA): Hampden-Sydney College.

Titus, J. J. (2008). Student ratings in a consumerist academy: leveraging pedagogical control and authority. *Sociological Perspectives, 51*(2), 397-422.

Tomas, S. & O'Grady, J. (2009). *Engineering and Technology Labour Market Study. Right for Me? A Study of Factors That Shape the Attitudes of Young Women Towards Mathematics and Science and Towards Careers in Engineering and Technology.* Toronto (ON): Engineers Canada and Canadian Council of Technologies and Technologists.

Tremblay, M. (2005). *Du droit d'elire et d'etre elues au droit de representer et d'etre representees: une lecture de la citoyennete politique des femmes*. Montréal, QC: Les Editions du Remue-Menage.

Turner, C. S. V. (2002). Women of color in academe: living with multiple marginality. *The Journal of Higher Education, 73*(1), 74-93.

Turpin, D. (2012). *Canadian University Presidents Project*. Presented at the AUCC Members Meeting. Victoria (BC): University of Victoria.

UBC (University of British Columbia) (2008). *Policy on Faculty Mentoring.* Vancouver (BC): Department of Anesthesiology, Pharmacology and Therapeutics, University of British Columbia.

UBC (University of British Columbia) (n.d.a). General waiting list information. Retrieved April 3, 2012, from http://www.childcare.ubc.ca/admissions-and-waitlist-information/waitlist-application-and-information/waiting-time.

UBC (University of British Columbia) (n.d.b). *Bachelor of Education Program Policy Handbook*. Vancouver (BC): Faculty of Education, Teacher Education Office, UBC.

UN (United Nations) (2010) Department of Economic and Social Affairs. *The World's Women 2010: Trends and Statistics.* New York (NY): Department of Economic and Social Affairs, United Nations.

UNESCO (United Nations Educational, Scientific and Cultural Organization) (2007). *Science, Technology and Gender — An International Report*. Paris, France: UNESCO.

UNGA (United Nations General Assembly) (1948). *Universal Declaration of Human Rights*. Paris, France, 10 December 1948, 217 A (III).

UNGA (United Nations General Assembly) (1979). *UN Convention on the Elimination of All Forms of Discrimination Against Women*. New York, 18 December, 1979. Resolution 34/180. Entered into force 3 September 1981.

U of K (University of Konstanz) (2011). *Science Goes Family*. Konstanz: Gleichstellungsrat der Universität Konstanz (Office for Equal Opportunity and Family Affairs).

U of T (University of Toronto – Early Learning Centre) (2011). Fee and Payment — St. George. Retrieved April 2, 2012, from http://elc.utoronto.ca/2011/12/02/fees-and-payment-st-george/.

U of T (University of Toronto Archives & Records Management Services) (2012). Clara Cynthia Benson. Retrieved Jan. 13, 2012, from http://utarms.library.utoronto.ca/researchers/fond-listings/clara-cynthia-benson.

U of W (University of Waterloo) (2002). *Welcoming Women Faculty – The Report of the Provost's Task Force on Female Faculty Recruitment*. Waterloo (ON): University of Waterloo.

University of Michigan (2009–2010). *Handbook for Faculty Searches and Hiring: Academic Year 2009–10*. Ann Arbor (MI): ADVANCE Program, University of Michigan.

University of Michigan (2011). ADVANCE Program Overview. Ann Arbor (MI): Advance Program, University of Michigan.

UTS (University of Technology Sydney) (n.d.). IIWE Program in Paris, France. Retrieved April 4, 2012, from http://utswomeninengineeringandit.blogspot.ca/p/iiwe.html.

UWO (University of Western Ontario) (2010). *Faculty Collective Agreement Between the University of Western Ontario and the University of Western Ontario Faculty Association — July 1, 2010–June 30, 2014*. London (ON): University of Western Ontario.

University of Toronto (n.d.). University of Toronto Family Care Office — Home Page. Retrieved Jan. 13, 2012, from http://www.familycare.utoronto.ca/about_us/index.html.

Valian, V. (1999). *Why So Slow? The Advancement of Women*. Cambridge (MA): MIT Press.

Valian, V. (2006). *Tutorials for Change: gender schemas and science careers*. Retrieved May 3, 2012, from http://www.hunter.cuny.edu/gendertutorial/index.html.

Vallès Peris, N., & Caprile Elola-Olaso, M. (2009). *Construction of Gendered Technological Identities in the School Space*. Paper presented at the 2009 Gender & ICT, University of Bremen, Bremen, Germany. http://www.informatik.uni-bremen.de/soteg/gict2009/proceedings/GICT2009_VallesPeris.pdf.

Varpolotai, A. (2010). The status of women at Canadian universities and the role of faculty unions. *Forum on Public Policy*, 2010(2), 1-18.

Vinnova (2007). *Promotions for Female Researchers: The Vinnmer Programme.* Stockholm, Sweden: Swedish Governmental Agency for Innovation Systems.

Wagner, A., Acker, S., & Mayuzumi, K. (2008). Bridging the gap: I will not remain SILENCED. In D. A. Murray (Ed.), *Whose University is it Anyway?* Toronto (ON): Sumach Press.

Wennerås, C., & Wold, A. (1997). Nepotism and sexism in peer-review. *Nature*, *387*, 341-343.

White, J. S. (2005). Pipeline to Pathways: new directions for improving the status of women in campus. *Liberal Education*, *91*(1), 22-27.

Whitten, B. L., Dorato, S. R., Duncombe, M. L., Allen, P. E., Blaha, C. A., Butler, H. Z., & Williams, B. A. (2007). What works for women in undergraduate physics and what we can learn from women's colleges. *Journal of Women and Minorities in Science and Engineering*, *13*(1), 37-76.

Whitten, B. L., Foster, S. R., Duncombe, M. L., Allen, P. E., Heron, P., McCullough, L.,. Zorn, H. M. (2004). "Like a family": what works to create friendly and respectful student faculty interactions. *Journal of Women and Minorities in Science and Engineering*, *10*(3), 229-242.

WHO (World Health Organization) (2012). What do we mean by "sex" and "gender?". Retrieved January 13, 2012, from http://www.who.int/gender/whatisgender/en/.

Williams, C. (2010). Economic Well-being. Component of Statistics Canada Catalogue no. 89-503-X, *Women in Canada: A Gender-based Statistical Report.* Ottawa (ON): Statistics Canada.

Williams, J. C. (2004). Hitting the Maternal Wall. *Academe*, *90*(6), 16-20.

Williams, W. M., & Ceci, S. J. (2012). When scientists choose motherhood. *American Scientist*, *100*(2), 138.

WISE (2010a). About WISE. Retrieved March 30, 2012, from http://www.wiseworkshops.ca/about.

WISE (2010b). Special Programs. Retrieved March 30, 2012, from http://www.wiseworkshops.ca/specialprograms.

Wolf-Wendel, L., Susan B. Twombly, and Suzanne Rice. (2003). *The Two-Body Problem: Dual-Career-Couple Hiring Practices in Higher Education*. Baltimore (MD): The Johns Hopkins University Press.

Wolfinger, N. H., Mason, M. A., & Goulden, M. (2009). Stay in the game: gender, family formation and alternative trajectories in the academic life course. *Social Forces*, *87*(3), 1591-1621.

Woodhams, C., & Corby, S. (2007). Then and now: disability legislation and employers' practices in the UK. *British Journal of Industrial Relations*, *45*(3), 556-580.

Woolley, A. W., Chabris, C. F., Pentland, A., Hashmi, N., & Malone, T. W. (2010). Evidence for a collective intelligence factor in the performance of human groups. *Science*, *330*(6004), 686-688.

Worswick, C., & Warman, C. (2009). Mandatory retirement rules and the retirement decisions of university professors in Canada. *Queen's Economics Department Working Paper No.1202*. Kingston (ON).

Wright, D. T. (1971). *Post-Secondary Education in Ontario: A Statement of Issues*. Toronto (ON): Commission on Post-secondary Education in Ontario.

Xie, Y., & Shauman, K. A. (1997). Modelling the sex-typing of occupational choice: influences of occupational structure. *Sociological Methods & Research*, *62*(4), 1208-1233.

Xie, Y., & Shauman, K. A. (2003). *Women in Science: Career Processes and Outcomes*. Cambridge (MA); London, United Kingdom: Harvard University Press.

Appendices

Appendices: Assessment on Women in University Research

PURPOSE AND OVERVIEW

In March 2010, the Council of Canadian Academies convened an expert panel to conduct an assessment of:

"The factors that influence university research careers, both in Canada and internationally."

This assessment was requested by the Minister of Industry and charged the Panel to focus specifically on what policies and what societal, cultural, and institutional (e.g., universities, funding agencies), economic and/or other relevant factors (as determined by the Council's Expert Panel) influence the career trajectory of women researchers in Canadian universities and underlie gender disparities observed in Canadian university researcher's statistical profile, by discipline area, rank, duty/position/stature, salary, tenure, research funding and/or any other relevant indicators (as determined by the Expert Panel)?

As part of their response to the charge, the Panel launched evidence-gathering activities, which included an analysis of data from Statistics Canada's census, Post-Secondary Student Survey and University College Academic Staff System Survey, federal granting agencies and data from international data sources including Eurostat education database. Evidence was also collected via a comprehensive literature review, a secondary analysis on a survey of Canada Research Chairs, and interviews with professionals in the private sector.

These appendices present the methodology, supporting results and analysis of quantitative data, and the summary of the results of a qualitative survey. The appendices do not contain conclusions or findings, as these are found in the Panel's assessment report.

Appendix 1 Methodology

A1.1 QUANTITATIVE DATA METHODOLOGY

In order to cover the Canadian context in different research fields and to build longitudinal data, the Panel requested data from Statistics Canada, principally from the Census, the University and Colleges Staff System (UCASS), and the Postsecondary Student Information System (PSIS). The Panel also obtained published and unpublished data from the Association of Universities and Colleges of Canada (AUCC), the Canadian Association of University Teachers (CAUT), and the Natural Sciences and Engineering Research Council (NSERC) report on *Women in Science and Engineering in Canada*. Using different datasets required the use of slightly different definitions (from a quantitative point of view) of a university researcher. As a result, some discrepancies may exist among datasets. The Natural Sciences and Engineering Research Council (NSERC), the Social Sciences and Humanities Research Council (SSHRC), the Canadian Institutes of Health Research (CIHR), and the Canada Research Chairs program (CRC) also provided data.

Despite the extensive literature on the subject, the Panel identified the following limitations:

- relatively little literature specific to the Canadian context;
- lack of longitudinal data;
- relatively few studies (both quantitative and qualitative) dealing with fields such as the humanities and social sciences; and
- lack of comprehensive data and evidence from the private and government sectors.

The Panel used quantitative evidence from the following Statistics Canada data sources:

- Census from 1971 to 2006;
- University Student Information System (USIS), from years 1972–1973 to 1990–1991;
- Postsecondary Student Information System (PSIS), from years 1991–1992 to 2008–2009;
- University and College Staff System (UCASS), from years 1970–1971 to 2008–2009; and
- Survey of Earned Doctorate (SED), year 2007–2008.

To protect the confidentiality of the data Statistics Canada randomly rounds frequencies to a multiple of three.

Census Data

Definition of Researcher: Different datasets (e.g., census data and UCASS datasets) define a university researcher in slightly different ways. In the context of the census data, a university researcher is defined as a respondent who indicated:

- PhD holder
- Occupation = University professor
- Industry = University education
- Working full-year, full-time (FY-FT)

It captures individuals in the population aged 15 and over in Private Households in Occupied Private Dwellings, persons with a doctorate who were employed full-year, full-time and for whom the occupation is "University professor." In addition to professors, it includes heads of departments, but excludes faculty deans and teaching and research assistants.

Fields of Study: To define the fields of study, Statistics Canada used the aggregation created for the different census years based on the major field of study classification.[79]

- *Humanities, social sciences and education (HSE):* Educational, Recreational and Counselling Services, Fine and Applied Arts, Humanities and Related Fields, Social Sciences and Related Fields, Commerce, Management and Business Administration.
- *Life sciences (LS):* Agricultural, Biological, Nutritional and Food Sciences, Health Professions and Related Technologies.
- *Physical sciences, mathematics, computer and engineering (PCEM):* Engineering and Applied Sciences, Applied Science Technologies and Trades, Mathematics, Computer and Physical Sciences.

UCASS Data

The purpose of UCASS data is to "collect national data on selected socio-economic characteristics of full-time teaching staff at Canadian degree-granting institutions (universities and colleges)."[80] Information for each individual staff member employed by the institution as of October 1st of the academic year is collected. In the context of this study, only data from university staff was collected. More precisely, the study population includes all full-time teaching staff who hold an

79 Please see http://stds.statcan.gc.ca/mfs-pde/lev0-niv0-eng.asp for more information.

80 For more information, see http://www.statcan.gc.ca/cgi-bin/imdb/p2SV.pl?Function=getSurvey&SDDS=3101&lang=en&db=imdb&adm=8&dis=2

earned doctorate degree and are employed in public or private degree-granting institutions. It also includes full-time research staff who have an academic rank and a salary scale similar to teaching staff.

Fields of Study: For UCASS data, fields of study were roughly similar to the large fields of study retrieved for the census data. UCASS fields of study were retrieved as follows:

- *Humanities, social sciences and education (HSE):* Education, Fine and Applied Arts, Humanities and Related, Social Sciences and Related Fields.
- *Life sciences (LS):* Agricultural and Biological Sciences, Health Professions and Occupations.
- *Physical sciences, mathematics, computer and engineering (PCEM):* Engineering and Applied Sciences, Mathematics and the Physical Sciences, including chemistry and computer science.

Types of Universities: Canadian universities were broken down into four categories as follows.

- Undergraduate only: Universities that only provide undergraduate programs.
- GradNoMed: Universities with at least one graduate program but no medical school.
- GradMed: Universities with graduate programs and medical school.
- ENG: Universities specialized in engineering.

Postsecondary Student Information System

The Panel retrieved information on student enrolment and graduates in Canadian postsecondary education institutions from the postsecondary student information system (PSIS). For years prior to 1992, data were retrieved from the University Student Information System (USIS). Fields of studies from the USIS and PSIS databases were mapped to the large fields of study described above and outlined respectively in Tables A1.1 and A1.2. Only instructional programs that lead to a PhD level program were mapped to a large field. Other subjects were mapped to the category "other." Please note that since USIS and PSIS are two separate databases, data before 1992 and after 1992 should be treated as two different data sets.

Table A1.1

Field of Studies Mapping (USIS)

This table maps USIS fields of study (for enrolment and earned degree data) to those used in this report.

Field of Study (used in the USIS database)	Large Field of Study (used in the present report)
Agricultural and biological sciences	Life sciences
Arts and science	Humanities, social sciences and education
Education	Humanities, social sciences and education
Engineering and applied sciences	Physical sciences, computer science, engineering, and mathematics
Fine and applied arts	Humanities, social sciences and education
Health professions and occupations	Life sciences
Humanities and related	Humanities, social sciences and education
Mathematics and physical sciences	Physical sciences, computer science, engineering, and mathematics
Not applicable	Other
Not reported	Other
Social sciences and related	Humanities, social sciences and education

(Council of Canadian Academies)

Table A1.2

Field of Studies Mapping (PSIS)

This table maps PSIS fields of study to those used in this report. Fields that do not lead to PhD studies were mapped to the category "other."

Canadian Instructional Program classification (used in PSIS)	Large field
Agriculture, Agriculture Operations and Related Sciences	Life sciences
Natural Resources and Conservation	Life sciences
Architecture and Related Services	Physical sciences, mathematics, computer and engineering
Area, Ethnic, Cultural and Gender Studies	Humanities, social sciences and education
Communication, Journalism and Related Programs	Humanities, social sciences and education
Communications Technologies/ Technicians and Support Services	Physical sciences, mathematics, computer and engineering
Computer and Information Sciences and Support Services	Physical sciences, mathematics, computer and engineering
Personal and Culinary Services	Other
Education	Humanities, social sciences and education
Engineering	Physical sciences, mathematics, computer and engineering
Engineering Technologies/Technicians	Other

continued on next page

Canadian Instructional Program classification (used in PSIS)	Large field
Aboriginal and Foreign Languages, Literatures and Linguistics	Humanities, social sciences and education
Family and Consumer Sciences/Human Sciences	Humanities, social sciences and education
Technology Education/Industrial Arts Programs	Other
Legal Professions and Studies	Humanities, social sciences and education
English Language and Literature/Letters	Humanities, social sciences and education
Liberal Arts and Sciences, General Studies and Humanities	Humanities, social sciences and education
Library Science	Humanities, social sciences and education
Biological and Biomedical Sciences	Life sciences
Mathematics and Statistics	Physical sciences, mathematics, computer and engineering
Reserve Entry Scheme for Officers in the Armed Forces	Other
Military Technologies	Other
Multidisciplinary/Interdisciplinary Studies	Other
Parks, Recreation, Leisure and Fitness Studies	Humanities, social sciences and education
Basic Skills	Other
Citizenship Activities	Other
Health-related Knowledge and Skills	Other
Interpersonal and Social Skills	Other
Leisure and Recreational Activities	Other
Personal Awareness and Self-improvement	Other
Philosophy and Religious Studies	Humanities, social sciences and education
Theology and Religious Vocations	Humanities, social sciences and education
Physical Sciences	Physical sciences, mathematics, computer and engineering
Science Technologies/Technicians	Other
Psychology	Humanities, social sciences and education
Security and Protective Services	Other
Public Administration and Social Service Professions	Humanities, social sciences and education
Social Sciences	Humanities, social sciences and education
Construction Trades	Other
Mechanic and Repair Technologies/Technicians	Other
Precision Production	Other
Transportation and Materials Moving	Other
Visual and Performing Arts	Humanities, social sciences and education

continued on next page

Canadian Instructional Program classification (used in PSIS)	Large field
Health Professions and Related Clinical Sciences	Life sciences
Business, Management, Marketing and Related Support Services	Humanities, social sciences and education
High School/Secondary Diploma and Certificate Programs	Other
History	Humanities, social sciences and education
French Language and Literature/Letters	Humanities, social sciences and education
Dental, Medical and Veterinary Residency Programs	Life sciences
Other instructional program	Other

Synthetic Cohorts

Since there are no longitudinal data that follow the career paths of individuals through time, a synthetic cohort methodology was used. This methodology examines the characteristics of a given age group, for example, 30–34 year olds in 1971, then 35–39 year olds five years later in 1976, 40–44 year olds in 1981 and so on. Using this approach, it should be noted that individuals are not necessarily the same in each age group, due to immigration, deaths, entry into a given occupation/leavers. Synthetic cohort data are presented in the report in Table 3.2, and in Tables A2.2; A2.3; and A2.4 in Appendix 2.

Granting Councils

Federal financial investments in research and development in the higher education sector are administered through three major agencies, the Canadian Institutes of Health Research (CIHR), the Natural Sciences and Engineering Research Council (NSERC), and the Social Sciences and Humanities Research Council (SSHRC). In support of the assessment, the Panel requested data from the three major federal granting agencies as well as the Canada Research Chairs program. In particular, the Panel requested gendered data on the number of applicants, number of awards granted and success rates (number of awards/number of applicants by gender) for research grants awarded to academic researchers and post-doctoral fellows from the tri-council agencies and success rates from the Canada Research Chairs program. Data from each agency were collected for the period 2000–2011, and were based on the following granting programs:

Canadian Institutes of Health Research (CIHR)

- CIHR Research Grants
- Post-doctoral fellowship competition

Natural Sciences and Engineering Research Council (NSERC)
- Discovery Grants Program
- NSERC Post-doctoral fellowships

Social Science and Humanities Research Council (SSHRC)
- Standard Research Grants
- SSHRC Post-doctoral fellowships

Canada Research Chairs Program
- Tier 1 Chairs
- Tier 2 Chairs

Limitations in granting council data include:
- the absence of a standardized vocabulary to describe research subject areas;
- because of the lack of common tracking mechanism among the granting councils, it is challenging to combine information on specific researchers that have received grants from multiple agencies.

A1.2 QUALITATIVE DATA METHODOLOGY

To the extent that it was feasible and to overcome clear gaps, some primary qualitative data were collected via telephone interviews conducted by Panel Members and staff with individuals in the private and not-for-profit sectors. In order to gain a stronger understanding of the perspectives of research institutions, the Panel distributed letters and email surveys to universities, the private sector, and government departments. The response rate was poor, thereby adding to the challenge regarding the availability of data.

Because of the important role that the Canada Research Chairs program has in promoting Canadian research, as well as the issues identified with the program, the Panel also commissioned a secondary analysis of the qualitative data contributed by women, about women, or related to issues facing women, from web surveys and telephone interviews that were collected through a sub-study conducted as part of the Canada Research Chairs Program. This was conducted by the original author of the study (the report including methodology is located in Appendix 5), the results of which are integrated throughout the report with the purpose of speaking to the issues identified in the literature.

Finally, the Panel took an innovative approach to painting a more vibrant picture of the experience of women professors by sharing their personal testimony in the form of "life-writing." Life-writing is the generic name given to a variety of forms

of personal narrative — autobiography, biography, personal essays, letters, diaries, and memoirs. Publishing personal testimony is a vital strategy for marginalized groups to claim their own voices and tell their own stories. Academic women's life-writing adds important evidence to a study of women in university careers (Robbins *et al.*, 2011). The first study of academic life-writing appeared in the U.S. in 2008 (Goodall, 2008); as of yet, none exists for Canada. However, several collections of personal essays and life-writing such as *The Madwoman in the Academy: 43 Women Boldly Take on the Ivory Tower* (Keahey & Schnitzer, Eds., 2003), *Women in the Canadian Academic Tundra: Challenging the Chill* (Hannah *et al.*, Eds., 2002), and *Minds of Our Own* (Robbins *et al.*, Eds., 2008) highlight women's experience in Canadian academia through their own words. Recognizing the benefits of this approach, which focuses on the importance of women's voices and stories, the Panel chose to weave personal narrative from women academics throughout the body of the report to emphasize their very real observations as they navigate along academic paths.

Secondary Analysis of Gender Barriers in the Canada Research Chairs Program

For the complete methodology, please see Appendix 5.

Data from Institutions

In order to identify institutional factors that may have an impact on the career trajectories of women versus men, to try and capture data collected at the institution level (representation of postdoctoral students by gender; time to completion rates of postdoctoral students by gender, and application success rates by gender and discipline, and to determine whether there were any "best practices" at the institutional level to encourage the hiring, retention or promotion of women researchers), a letter of request was sent to every VP Academic and Provost of each university in Canada from the President of the Council of Canadian Academies.

Data from the Private Sector and Government

In order to obtain data to answer the sub-question on whether women researchers in government, non-governmental organizations, and the private sector face similar challenges as women researchers in academia, a case study approach was adopted to try and provide a snapshot of the issues and challenges that face women researchers in these other sectors.

According to the 2006 Canadian Census, the distribution of female doctoral holders in industries was distributed as follows: 45.9 per cent in educational services; 21.4 per cent in health care and social services; 9.7 per cent in professional, scientific and technical services; 6.6 per cent in public administration; 2.4 per cent

in manufacturing and the remainder in other industries and services. A list of representative companies was compiled, using a directory found at http://www.ic.gc.ca/cis-sic.nsf/IDE/cis-sic62cheae.html. E-mails were sent to representatives in 14 of these groups to solicit information on the challenges that women researchers face outside of academia. The Panel received five responses. The following questionnaire was sent out:

- Can you provide the Panel with a gender breakdown of your research workforce (either in real or percentage terms)?
- What is the typical career path for a researcher in the company?
- What are some of the challenges to progression for a researcher (e.g., resources, family obligations, access to teams, lab access etc.)? Are any of these challenges unique to women researchers?
- Do researchers move into other career paths such as management? If so, what is the proportion of women in management?
- Does the company have any policies or practices to recruit women researchers into the company?
- What are some of the best practices used to retain and promote women researchers?

In order to ascertain the sociocultural limitations/barriers that women researchers may face within the private sector, we propose the following questions:

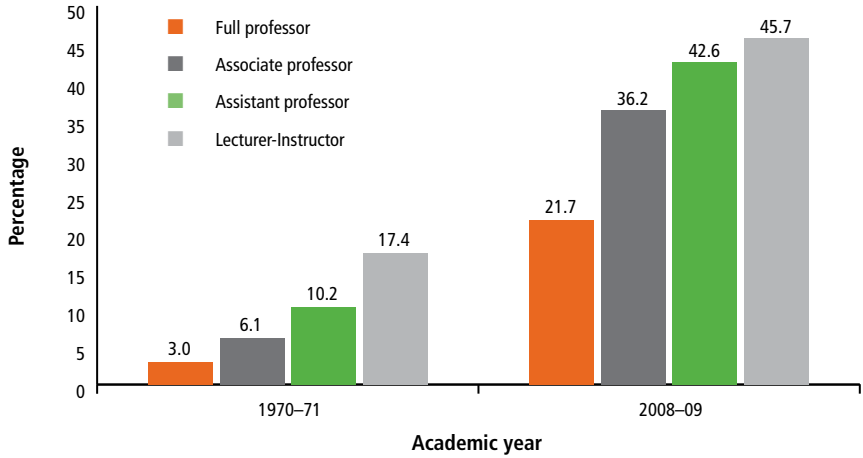
- Do you have any policies that mandate that a percentage/ratio of women serve in a research leadership capacity such as at the executive level?
- Does the company offer any programs and/or grants to encourage women to pursue careers in science and technology?
- In the industry, are there any work culture issues that may serve as a deterrent for women in researcher career paths?
- Does your company possess any code of conduct that may address issues of discrimination, particularly based on gender? If so, is this an industry standard?

In addition, e-mail and phone exchanges were undertaken with representatives from six central government agencies, including the Federal Science and Technology Community Management Secretariat, the Treasury Board of Canada, Human Resources and Skills Development Canada's Labour Program, Defence Research and Development Canada, the National Research Council, and the Privy Council Office to obtain data about the size and gender of researchers within the government of Canada. No attempt was made to get similar data from provincial or territorial governments. While some individuals provided the Panel with useful documents, no data regarding the numbers of women researchers employed by the Government of Canada was provided due to a lack of statistics in some cases, and privacy concerns in other cases.

Appendix 2 Landscape Analysis

A2.1 DESPITE INCREASES, WOMEN ARE STILL UNDERREPRESENTED IN ALL THREE LARGE FIELDS OF STUDY AT ALL LEVELS OF ACADEMIA

As described in Chapter 3, in 2009, women were underrepresented in the aggregated fields of study (HSE, LS, PCEM) and at all ranks. This is despite major increases in women's representation in universities over the past 40 years. Figure A2.1 shows that in 1970–1971, the representation of women at senior secure positions was even lower, accounting for only 3.0 per cent of individuals at the full professor position (Statistics Canada, n.d.d.) Reasons for this phenomenon have been discussed in chapters 4 and 5 in this report.



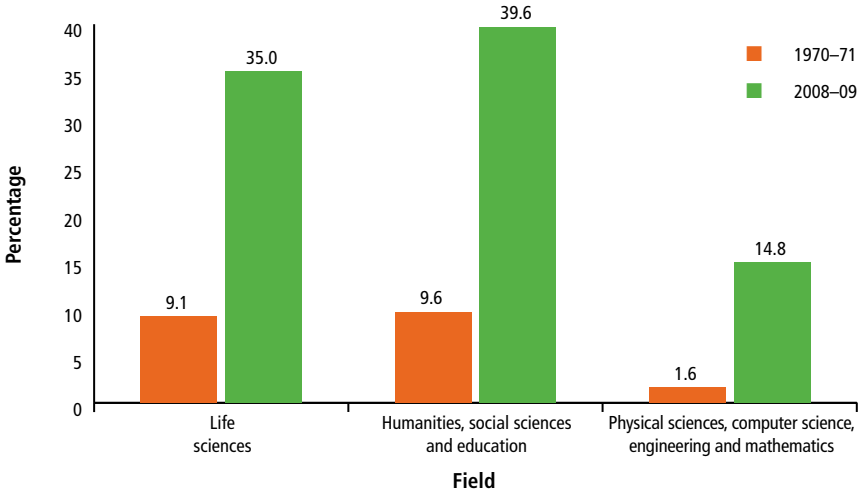
(Data Source: Statistics Canada, n.d.d.)

Figure A2.1

Representation of Women Among Ranks of University Professors and Researchers (1970–71 and 2008–09)

A2.2 THE CAREER PATHWAYS OF WOMEN ARE INFLUENCED DIFFERENTLY DEPENDING ON THE FIELD OF DISCIPLINE ENTERED

Overall, the aggregated representation of women among university researchers hides important disparities among fields. The representation of women in HSE is the highest with 39.6 per cent of women followed by LS (35 per cent). Although PCEM is the field of research where the representation of women is the lowest, this is also the field where the proportion of women has increased the most since 1971 (see Figure A2.2).



(Data Source: Statistics Canada, n.d.d.)

Figure A2.2

Representation of Women in the Three Large Fields of Study (1970–71 and 2008–09)

A2.3 LARGE FIELDS ARE NOT HOMOGENEOUS

Table A2.1

Selected Sub-fields of Education, by Gender and Level of Education

This table depicts variations in women's representation in different disciplines within the large fields of study.

		Undergraduate			Master's			PhD		
		Female	Male	Female (%)	Female	Male	Female (%)	Female	Male	Female (%)
PCEM	Civil Engineering	381	1,323	22.4	183	468	28.1	24	129	15.7
	Environmental Engineering	48	72	40.0	9	21	30.0	3	6	33.3
HSE	Economics	1,581	2,379	39.9	297	393	43.0	27	57	32.1
	Education	14,265	4,284	76.9	3,171	987	76.3	231	105	68.8
LS	Genetics & Heredity	126	96	56.8	30	18	62.5	30	21	58.8
	Nursing	8,034	726	91.7	747	60	92.6	42	6	87.5

(Data Source: Statistics Canada, n.d.f.)

A2.4 UNIVERSITY CAREERS

The Panel disaggregated by field of study the data presented in Table 3.2 of the report (Statistics Canada, n.d.b.; n.d.d.; n.d.e.). This "synthetic cohort" perspective for the HSE, LS, and PCEM fields is presented in tables A2.2, A2.3, and A2.4. Among those three fields, PCEM shows the greatest progress, albeit from a much lower starting position. The percentage of women as full professors has more than tripled in the past decade, exceeding the 2.5-fold corresponding increase in PhD graduates from 1971 to 1981 (see Table A2.4). In contrast, in LS, the proportion of female PhDs more than doubled from 1971 to 1981, but the percentage of full professors did not quite double in the period 25 years later from 1996 to 2006 (see Table A2.3). Finally for the same cohorts, HSE saw roughly a doubling of the percentage female at all stages of the career (PhD, assistant professor, associate professor and full professor) when a (synthetic) cohort is followed (i.e., diagonally down and to the right in Table A2.2).

Table A2.2

Moving Through the Ranks in Humanities, Social Sciences and Education: A University Cohort Analysis

This table shows the estimates of the proportion of women with earned PhDs, at the level of assistant professor, associate professor and full professor in HSE. The proportions are broken down by age range and selected years. Three "complete" and "standard" career paths are indicated in the table by the black, blue and green highlighted percentages of women, reading diagonally down and to the right, emphasized by the rectangular red box. In reality, career paths differ according to the circumstances of individual researchers. With this in mind, all data are presented to enable readers to chart alternative career paths (that account for time off or a longer period of time spent in one position, for example). For faculty data, dates are provided for a given academic year. For example, 1981 corresponds to the academic year 1980–1981. Considering that these data have been constructed from several data sets (as opposed to a true cohort analysis which would follow the same population of researchers over time), readers are asked to bear in mind that these proportions are estimates and interpret the results with caution.

Year of earned PhD	Earned PhD (% female)	Assistant professor (% female)			Associate professor (% female)				Full professor (% female)			
Age range		30–39	35–44	40–49	35–44	40–49	45–54	50–59	40–49	45–54	50–59	55–64
1970–71	**16.2***	12.2	13.8	25.5	6.6	10.9	13.4	20.6	2.9	3.0	4.8	6.1
1975–76	**26.6**	**15.1**	18.2	24.1	8.9	10.9	17.1	19.8	4.6	5.3	5.7	7.5
1980–81	**33.9**	**22.2**	22.6	26.1	12.3	12.2	14.3	21.3	5.6	6.4	6.4	7.1
1985–86	39.1	**28.3**	28.8	34.0	17.2	**15.9**	14.4	15.5	8.3	7.9	8.6	9.7
1990–91	45.6	35.1	36.6	42.1	24.8	**22.1**	19.8	16.9	11.6	10.8	9.6	8.8
1995–96	47.7	43.9	44.2	45.2	34.2	**33.7**	30.5	25.4	18.4	15.2	**13.6**	11.7
2000–01	57.2	44.3	45.8	47.6	41.2	41.5	39.9	35.5	25.6	24.0	**19.6**	16.5
2005–06	57.7	44.5	45.4	48.2	42.0	44.9	43.7	41.7	29.9	29.9	**27.3**	22.2

(Data Source: Statistics Canada, n.d.b., n.d.d., n.d.e.)

*Earned PhD data were not available for the year 1971. As a result, earned PhD data presented for the year 1971 correspond to the year 1972.

Table A2.3

Moving Through the Ranks in Life Sciences: A University Cohort Analysis

This table shows the estimates of the proportion of women with earned PhDs, at the level of assistant professor, associate professor and full professor in LS. The proportions are broken down by age range and selected years. Three "complete" and "standard" career paths are indicated in the table by the black, blue and green highlighted percentages of women, reading diagonally down and to the right, emphasized by the rectangular red box. In reality, career paths differ according to the circumstances of individual researchers. With this in mind, all data are presented to enable readers to chart alternative career paths (that account for time off or a longer period of time spent in one position, for example). For faculty data, dates are provided for a given academic year. For example, 1981 corresponds to the academic year 1980–1981. Considering that these data have been constructed from several data sets (as opposed to a true cohort analysis which would follow the same population of researchers over time), readers are asked to bear in mind that these proportions are estimates and interpret the results with caution.

Year of earned PhD	Earned PhD (% female)	Assistant Professor (% female)			Associate professor (% female)				Full professor (% female)			
Age range		30–39	35–44	40–49	35–44	40–49	45–54	50–59	40–49	45–54	50–59	55–64
1970–71	**12.2***	9.4	11.5	25.7	7.5	11.9	14.8	23.1	4.6	5.1	4.2	6.7
1975–76	**19.9**	**9.5**	12.3	17.9	7.2	10.2	14.9	17.9	5.1	7.1	8.1	7.0
1980–81	**24.6**	**15.9**	18.2	22.6	8.9	10.7	12.2	16.9	3.8	6.3	9.5	10.2
1985–86	28.4	**20.8**	27.6	38.8	14.6	**14.2**	15.1	19.1	7.0	6.7	7.0	9.1
1990–91	31.9	28.6	28.3	34.6	21.7	**21.7**	21.3	22.7	9.9	9.4	7.9	7.2
1995–96	38.2	33.3	34.5	42.3	27.1	**28.5**	30.9	29.7	15.7	13.6	**11.5**	11.1
2000–01	40.8	36.4	36.8	42.1	31.5	32.7	37.2	39.5	20.8	18.6	**16.3**	13.2
2005–06	49.3	38.6	39.9	43.3	33.3	35.9	42.3	47.0	27.2	25.1	**22.5**	19.4

(Data Source: Statistics Canada, n.d.b., n.d.d., n.d.e.)

*Earned PhD data were not available for the year 1971. As a result, earned PhD data presented for the year 1971 correspond to the year 1972.

Table A2.4

Moving Through the Ranks in Physical Sciences, Computer Science, Engineering and Mathematics: A University Cohort Analysis

This table shows the estimates of the proportion of women with earned PhDs, at the level of assistant professor, associate professor and full professor in PCEM. The proportions are broken down by age range and selected years. Three "complete" and "standard" career paths are indicated in the table by the black, blue and green highlighted percentages of women, reading diagonally down and to the right, emphasized by the red rectangular box. In reality, career paths differ according to the circumstances of individual researchers. With this in mind, all data are presented to enable readers to chart alternative career paths (that account for time off or a longer period of time spent in one position, for example). For faculty data, dates are provided for a given academic year. For example, 1981 corresponds to the academic year 1980–1981. Considering that these data have been constructed from several data sets (as opposed to a true cohort analysis which would follow the same population of researchers over time), readers are asked to bear in mind that these proportions are estimates and interpret the results with caution.

Year of earned PhD	Earned PhD (% female)	Assistant Professor (% female)			Associate professor (% female)				Full professor (% female)			
Age range		30–39	35–44	40–49	35–44	40–49	45–54	50–59	40–49	45–54	50–59	55–64
1970–71	**3**	2.5	3.8	9.1	1.2	2.7	2.3	0.0	0.5	0.0	0.0	0.0
1975–76	**6.9**	**2.1**	4.5	9.5	1.5	3.1	4.8	3.4	0.7	0.4	0.0	0.0
1980–81	**7.7**	**5.7**	5.4	3.7	1.6	2.4	3.2	3.2	0.0	0.8	1.2	0.7
1985–86	9.9	**8.5**	9.6	13.9	3.4	**2.6**	2.0	4.1	1.4	0.9	1.2	1.2
1990–91	13.3	12.8	11.3	13.0	7.7	**6.8**	4.6	2.1	1.8	1.5	1.2	1.6
1995–96	14.7	17.3	19.5	22.2	11.4	**10.8**	8.4	4.4	4.3	3.0	**2.2**	1.5
2000–01	20.5	18.2	17.9	20.0	15.6	15.8	12.2	9.4	6.6	5.8	**4.0**	2.5
2005–06	20.3	20.9	18.9	16.7	15.8	16.0	15.4	10.9	11.3	10.2	**7.0**	4.6

(Data Source: Statistics Canada, n.d.b., n.d.d., n.d.e.)

*Earned PhD data were not available for the year 1971. As a result, earned PhD data presented for the year 1971 correspond to the year 1972.

A2.5 THE REPRESENTATION OF WOMEN VARIES BY THE TYPE OF UNIVERSITY

Table A2.5

Representation of Women Faculty by Type of University

In this dataset, all faculty are taken into account (with PhDs and without PhDs, all ranks) (Statistics Canada, n.d.b.). The proportion of women is measured against the entire faculty, in universities classified as GradMed, GradNoMed, Engineering or Undergrad (see appendix 1 for more details). Only institutions with over 50 faculty members are shown on this table.

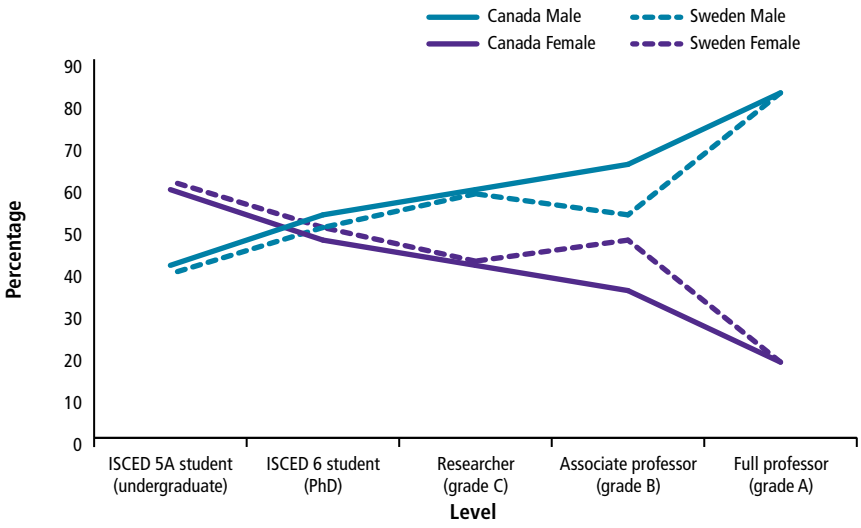
University name	Female (%)	Classification
Dalhousie University	38.9	GradMed
McGill University	29.8	GradMed
McMaster University	34.0	GradMed
Memorial University of Newfoundland	35.5	GradMed
Queen's University at Kingston	34.9	GradMed
Université de Montréal	34.8	GradMed
Université de Sherbrooke	35.3	GradMed
Université Laval	30.3	GradMed
University of Alberta	32.0	GradMed
University of British Columbia	32.6	GradMed
University of Calgary	34.0	GradMed
University of Manitoba	32.5	GradMed
University of Ottawa	35.9	GradMed
University of Saskatchewan	34.1	GradMed
University of Toronto	35.1	GradMed
University of Western Ontario	30.4	GradMed
Acadia University	29.4	GradNoMed
Athabasca University	45.6	GradNoMed
Bishop's University	31.6	GradNoMed
Brandon University	40.0	GradNoMed
Brock University	43.3	GradNoMed
Cape Breton University	41.5	GradNoMed
Carleton University	34.7	GradNoMed
Collège universitaire de Saint-Boniface	41.2	GradNoMed
Concordia University	35.2	GradNoMed
Concordia University College of Alberta	31.6	GradNoMed
École des Hautes Études Commerciales	27.8	GradNoMed
Institut national de la recherche scientifique	23.1	GradNoMed
Lakehead University	31.3	GradNoMed
Laurentian University of Sudbury	38.3	GradNoMed
Mount Saint Vincent University	61.7	GradNoMed

University name	Female (%)	Classification
Nipissing University	40.0	GradNoMed
Nova Scotia Agricultural College	22.7	GradNoMed
Ontario Institute of Technology	37.0	GradNoMed
Royal Military College of Canada	16.7	GradNoMed
Royal Roads University	29.4	GradNoMed
Ryerson University	42.1	GradNoMed
Saint Mary's University	35.0	GradNoMed
Simon Fraser University	34.1	GradNoMed
St. Francis Xavier University	43.4	GradNoMed
Télé-université	38.9	GradNoMed
Trent University	40.0	GradNoMed
Trinity Western University	33.3	GradNoMed
Université du Québec à Chicoutimi	31.6	GradNoMed
Université du Québec à Montréal	36.5	GradNoMed
Université du Québec à Rimouski	35.5	GradNoMed
Université du Québec à Trois-Rivières	33.9	GradNoMed
Université du Québec en Abitibi-Témiscamingue	37.1	GradNoMed
Université du Québec en Outaouais	44.1	GradNoMed
Université Saint-Paul	29.2	GradNoMed
University of Guelph	31.7	GradNoMed
University of Lethbridge	39.5	GradNoMed
University of New Brunswick	38.8	GradNoMed
University of Northern British Columbia	35.9	GradNoMed
University of Prince Edward Island	34.7	GradNoMed
University of Victoria	40.6	GradNoMed
University of Waterloo	25.1	GradNoMed
University of Windsor	35.2	GradNoMed
Wilfrid Laurier University	41.1	GradNoMed
York University	44.9	GradNoMed
École de technologie supérieure	12.5	Engineering
École Polytechnique de Montréal	10.1	Engineering
King's College	37.0	Undergrad
Mount Allison University	44.7	Undergrad
Ontario College of Art and Design	41.4	Undergrad
Saint Thomas University	41.7	Undergrad
Université de Moncton	37.6	Undergrad
University of Regina	37.0	Undergrad
University of Winnipeg	37.8	Undergrad

(Data Source: Statistics Canada, n.d.b.)

A2.6 WOMEN ARE UNDERREPRESENTED AT THE HIGHEST LEVELS OF ACADEMIC SCHOLARSHIP IN ADVANCED ECONOMIES

The case of Sweden is particularly distinct from other advanced economies. The proportion of women among associate professors (grade B) is significantly higher than in the other countries including Canada (see Figure A2.3) (European Commissions 2009; Statistics Canada, n.d.b.; Cacace, 2009).



(Data Source: European Commission, 2009; Statistics Canada, n.d.b; Cacace, 2009)

Figure A2.3

Canada Compared to Sweden: Different Profiles

This figure depicts the percentage of women and men in a typical academic career as of 2007. This figure includes students and academic staff in Canada and in Sweden.

Overall, Canada's profile is similar to comparator countries, which demonstrates a global challenge in maintaining equitable gender proportions throughout a typical academic career. On the other hand, Canada lags behind the European Union (EU) average and other comparative countries for the percentage of women researchers in the higher education sector overall in 2007, only ahead of Japan (Figure A2.4) (Cacace, 2009).

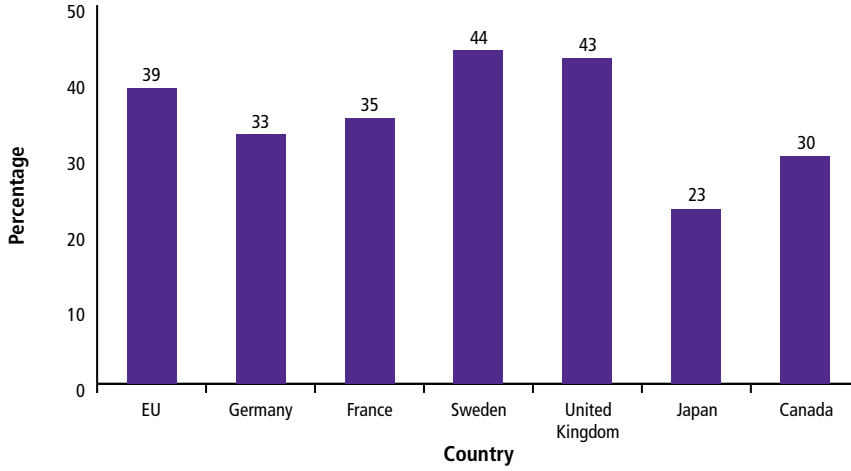


Figure A2.4

Share of Women Researchers in Selected Countries

This figure depicts the share of women researchers in the higher education sector (per cent of total researchers) in Canada and selected countries, as of 2007.

A2.7 ALTERNATIVE CAREER PATHS

Although one of the principal objectives of doing a PhD is to undertake a career in research, not all graduate students follow this path. This choice to engage in an alternative career path outside of academia may be a result of personal choice (such as individuals with PhDs who are in engineering but working in the private sector), or the consequence of an unsuccessful career in academia. Note that the career paths described here are not specifically research-oriented.

Table A2.6

Top Ten Occupations for Doctoral Degree Holders in Canada

Estimated number of persons in Canada with a doctoral degree who were employed full-year, full-time, by occupation and gender, for census year 2006. See Appendix 1 for further details on census data.

Occupation	Male	Occupation	Female
E11 – University professors and assistants	22,735	E11 – University professors and assistants	10,285
A – Management occupations, total	7,905	A – Management occupations, total	2,315
C01 – Physical science professionals	4,035	E02 – Psychologists, social workers, counsellors, clergy and probation officers	1,930
C07 – Computer and information systems professionals	3,140	D01 – Physicians, dentists and veterinarians	1,400
D01 – Physicians, dentists and veterinarians	3,125	E03 – Policy and program officers, researchers and consultants	1,375
E03 – Policy and program officers, researchers and consultants	2,435	B – Business, Finance and Administrative Occupations, total	1,340
C03 – Civil, mechanical, electrical and chemical engineers	2,360	C01 – Physical science professionals	1,015
E02 – Psychologists, social workers, counsellors, clergy and probation officers	2,360	C02 – Life science professionals	1,015
C02 – Life science professionals	2,315	(D03, D04, D1, D2, D3) – Health occupations, other	820
B – Business, Finance and Administrative Occupations, total	2,130	E12 – College and other vocational instructors	735

(Data Source: Statistics Canada, 2006e)

As indicated in Table A2.6, the highest concentration of PhD holders, male or female, are found in universities, employed as Professors and Assistants (Statistics Canada, 2006e). Outside of academia, management occupations were the second most common choice for both males and females, with 7,905 and 2,315 individuals respectively. Differences emerge as we go down the list in terms of career choices made by men and women with PhDs. Men tend to be employed as physical sciences professionals (rank 3), computer and information systems professionals (rank 4), and physicians, dentists and veterinarians (rank 5). Women, on the other hand, tend to work as psychologists, social workers, counsellors, clergy, and probation officers (rank 3), physicians, dentists, and veterinarians (rank 4), and policy and program officers, researchers, and consultants (rank 5). See Table A2.6.

Overall, the largest industry that employs PhD holders is educational services (Statistics Canada 2006j). This industry employs 27,425 males and 13,260 females,[81] or over half of the total population of employed doctoral degree holders in 2006. Although more males than females in total are employed in educational services, proportionately, about five percentage points more females (56.9 per cent) are employed in educational services than males (51.1 per cent) (see Table A2.7). Among women, the second most common industry is health care and social assistance, whereas men tend to be employed in professional, scientific, and technical services. Public administration and manufacturing rank four and five for both males and females.

Table A2.7

Top Five Industries for Doctoral Degree Holders in Canada

Estimated number of persons in Canada with a doctoral degree who were employed full-year, full-time, by industry and gender, for census year 2006. See Appendix 1 for further details on census data.

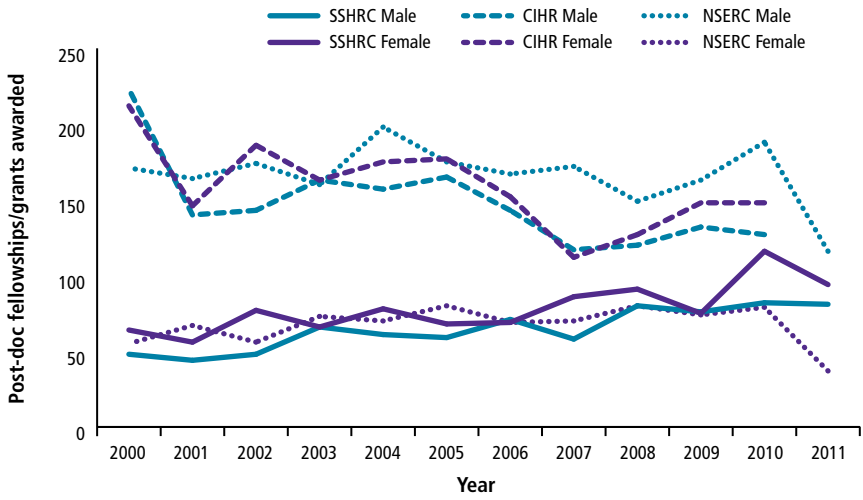
Industry	Male	Industry	Female
Educational services	27,425	Educational services	13,260
Professional, scientific and technical services	9,700	Health care and social assistance	5,030
Health care and social assistance	7,180	Professional, scientific and technical services	2,270
Public administration	5,750	Public administration	2,095
Manufacturing	3,575	Manufacturing	635

(Data Source: Statistics Canada, 2006j)

81 While this is different from the 11,000 researchers mentioned in the Executive Summary and Table 3.1, please note that 13,260 refers to *PhD holders* in general.

Appendix 3 Gender Equity in Research Funding

Although the graph shows some variability, overall, women and men experience comparable success rates from the tri-council grant agencies. With regards to CIHR and NSERC, men may also have higher success rates for post-doctoral grants in some years, although again, there is some variability. In PCEM, women are less well represented in the applicant pool, thus it is not surprising that they are awarded fewer post-doctoral fellowships or grants. Data regarding the success rates of female post-doctoral researchers in SSHRC-funded disciplines are inconclusive, considering that there is some annual variation in women's and men's success rates (see Table A3.1 and Figure A3.1) (CIHR, 2011; NSERC, 2011b; SSHRC, 2011b).



(Data Source: CIHR, 2011; NSERC, 2011b; SSHRC, 2011b)

Figure A3.1

Gender Distribution of Post-Doctoral Fellowships Awarded by Tri-Council Agencies by Competition Year

Table A3.1

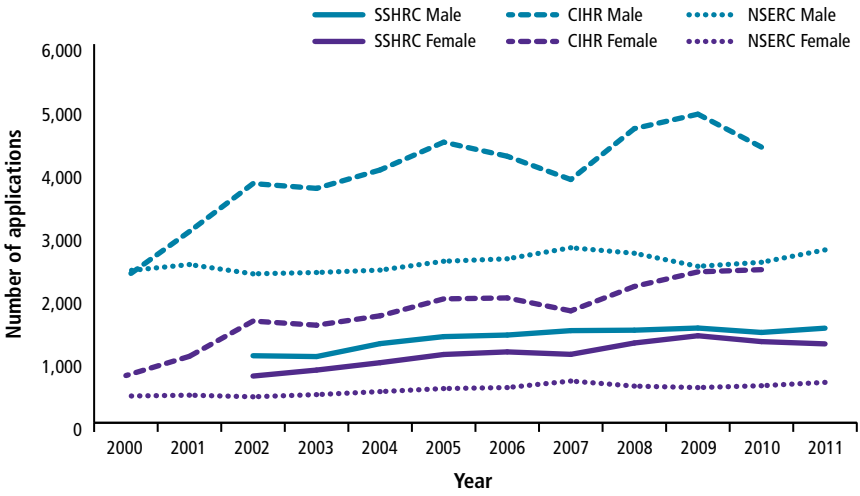
Post-Doctoral Fellowships: Success Rates

This table shows the success rates of women and men in obtaining post-doctoral fellowships from federal Tri-Council grant agencies, by fiscal year.

Year	CIHR Female	CIHR Male	NSERC Female	NSERC Male	SSHRC Female	SSHRC Male
2000	46.4	44.8	27.0	35.8	24.3	26.2
2001	30.9	36.0	35.8	37.8	28.4	25.4
2002	25.9	32.6	29.8	37.3	31.2	23.3
2003	25.2	28.1	33.0	31.7	25.0	30.0
2004	28.5	29.0	24.6	30.5	26.9	27.2
2005	28.9	31.3	27.4	29.8	21.3	24.5
2006	24.8	27.5	23.3	26.9	22.3	28.5
2007	22.5	22.9	22.3	24.2	25.7	24.2
2008	23.4	26.5	22.5	20.5	24.9	25.8
2009	19.0	23.1	19.2	22.0	17.5	22.7
2010	16.3	21.0	18.9	22.4	23.1	21.4
2011	NA	NA	9.4	12.2	19.0	21.2

(Data Source: CIHR, 2011; NSERC, 2011b; SSHRC, 2011b)

An analysis of the number of grant applications received by CIHR, NSERC, and SSHRC over the 10 year period from 2000–2010 reveals that there are distinct gender disparities in number of applications submitted among the three councils. CIHR receives approximately twice as many applications from men compared to women while NSERC receives five times as many applicants from men compared to women. In contrast, SSHRC receives approximately the equivalent number of applications from both genders (Figure A3.2).



(Data Source: CIHR, 2011; NSERC, 2011b; SSHRC, 2011b)

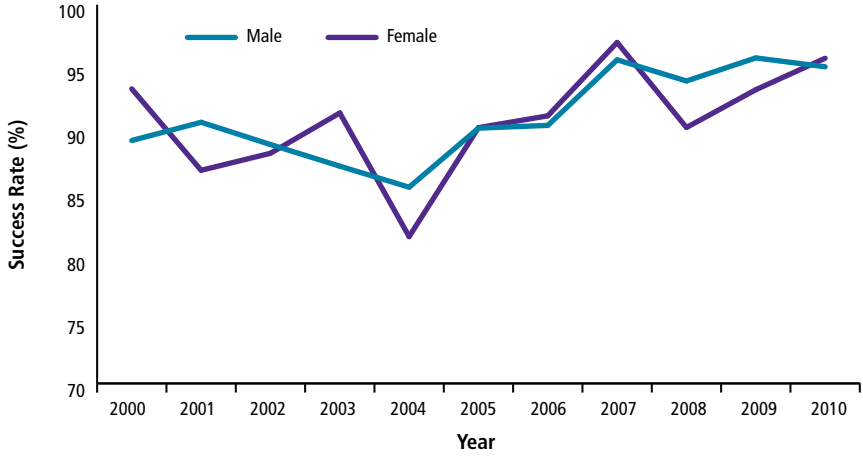
Figure A3.2

Tri-Council Grant Applications

This graph shows the distribution of Tri-Council grant applications of selected programs by competition year. Included are: CIHR Research Grants, NSERC Discovery Grants, and SSHRC Standard Research Grants.

Canada Research Chairs Program

The administration of awards from the Canada Research Chairs program differs from that of the tri-council funding agencies in that universities nominate researchers whose work complements their strategic research plan. This is in contrast to applicants with the tri-council agencies who may apply directly to the funding agencies. An analysis of the success rates of nominations to the Canada Research Chairs program shows that men and women experience roughly similar success rates in obtaining a chair award (see Figure A3.3). However, the number of nominations submitted is greater for male nominees in comparison to their female counterparts (Table A3.2) (CRC, 2011c).



(Data Source: CRC, 2011c)

Figure A3.3

Canada Research Chair Nominees – Success Rate in Obtaining Awards by Competition Year and Gender

Table A3.2

Canada Research Chairs Awards

This table depicts the composite table of nominees by sex for Canada Research Chairs Awards (2000–2010).

Year	Level	Approved				Rejected			
		Female	Male	Not Indicated	Total	Female	Male	Not indicated	Total
2000	Tier 1	21	167		188		17		17
	Tier 2	21	82		103	3	13	1	17
	Total	42	249		291	3	30	1	34
2001	Tier 1	16	174		190	1	19		20
	Tier 2	37	128		165	7	12		19
	Total	53	302		355	8	31		39
2002	Tier 1	22	121		143	1	9		10
	Tier 2	38	136	1	175	7	23		30
	Total	60	257	1	318	8	32		40
2003	Tier 1	36	120		156		14		14
	Tier 2	60	146		206	9	25		34
	Total	96	266		362	9	39		48
2004	Tier 1	21	82	1	104	4	8		12
	Tier 2	59	137		196	14	29		43
	Total	80	219	1	300	18	37		55

continued on next page

Year	Level	Approved				Rejected			
		Female	Male	Not Indicated	Total	Female	Male	Not indicated	Total
2005	Tier 1	15	58		73		6		6
	Tier 2	87	182		269	11	20	1	32
	Total	102	240		342	11	26	1	38
2006	Tier 1	19	84	1	104	1	5		6
	Tier 2	95	181		276	10	23		33
	Total	114	265	1	380	11	28		39
2007	Tier 1	21	150		171		3		3
	Tier 2	44	135	1	180	2	10		12
	Total	65	285	1	351	2	13		15
2008	Tier 1	13	108		121		9		9
	Tier 2	52	141		193	7	7	2	16
	Total	65	249		314	7	16	2	25
2009	Tier 1	28	129		157	2	2		4
	Tier 2	69	144	1	214	5	10		15
	Total	97	273	1	371	7	12		19
2010	Tier 1	31	114		145		5		5
	Tier 2	82	157	1	240	5	9		14
	Total	113	271	1	385	5	14		19

(Data Source: CRC, 2011c)

Appendix 4 Implementation Criteria of Illustrative Practices

As mentioned in Chapter 1, the Panel would have liked to assess the array of national and international practices against the criteria as laid out in the PRAGES (Cacace, 2009) report. These include:

- Relevance — the ability of a program to solve the issues it intended to solve
- Effectiveness — the capacity to achieve established goals
- Efficiency — in terms of access to and the use of human, financial, and technical resources
- Sustainability — the ability of a program to last

However, considering several practices have been implemented relatively recently, it was particularly challenging to evaluate practices against sustainability or effectiveness criteria. The Panel was also limited by the lack of technical information available about several practices, as well as constrained by time. As a result, the efficiency and effectiveness (or quality) of practices were difficult to evaluate. Given this, it was decided that while it was still important to identify relevant practices, these practices should be considered illustrative, as opposed to best.

Globally, there have been a number of initiatives that have been designed to promote gender equality in research. In recent times there has been a special emphasis in addressing the structural barriers that act as disincentives to women in research positions. In particular, solutions have been geared towards addressing the structural transformation of institutions, using a systemic, comprehensive, and sustainable approach.

Solutions can take a variety of forms including legislation, national committees for women in science, women and science departments, regular publication of statistics, gender equality plans at research organisations, gender balance targets dedicated programs, funding, and so on.

Complementary to the identification of illustrative practices are the conditions that would favour efficient implementation of these practices. It has been noted that successful measures have been implemented "in pairs, or groups." For instance, the existence of a "gender department" is complemented by "funding to women in science." "Targets" and "equality plans" also go together, and "mentoring

schemes" are usually associated with university equality plans and dedicated funding.[82] In terms of research institutions, it was noted that to address the barriers to women's career progress there are five major structural solutions that can be undertaken: making decision-making transparent; removing unconscious bias from institutional practices; promoting excellence through diversity; improving research by integrating a gender perspective; and modernizing human resources management and the working environment.[83]

These solutions are augmented by the existence of certain basic conditions that include taking gender seriously, increasing gender balance among gatekeepers, gender monitoring and publishing statistics on a regular basis differentiated by discipline, and ensuring accountability and transparency in research funding by publishing procedural criteria.[84]

An essential aspect is to have a statistical base to provide accurate sex-disaggregated data that can be assessed and allow progress monitoring. In addition, willingness at the top to open up discussion and to support the process of self-study is advantageous. This is coupled with an acknowledgement of the importance of the multifaceted role of department chairs and unit heads, who oversee the key processes of recruitment, retention, promotion, and pay. Fortunately, establishing these basic conditions is quite feasible and ultimately beneficial to the organization in the long run, under the condition that some dedicated budget is available to this end (gender budgeting).[85]

These implementation strategies emphasize the role that policy-makers, science institutions, top decision-makers, and gatekeepers of excellence play in order to advance gender equality in research and innovation.

82 *Benchmarking policy measures for gender equality in science* – EUR report 23314 EN.

83 *Structural Change in Research Institutions: Enhancing Excellence, gender equality and efficiency in research and innovation* – EUR report 24905 EN.

84 *The Gender Challenge in Research Funding: Assessing the European national scenes* – EUR report 23721 EN.

85 *Structural change in research institutions: Enhancing excellence, gender equality and efficiency in research and innovation* – EUR report 24905 EN.

Appendix 5 Factors that Influence the Career Trajectory of Women Researchers in Canadian Universities: Secondary Analysis of Data from the Canada Research Chairs Evaluation

Report contracted by the Council of Canadian Academies
Author & Principal Investigator: Natalie Kishchuk, Research and Evaluation Inc.

A5.1 INTRODUCTION

Mandated by the Minister of Industry, the Council of Canadian Academies is currently conducting an assessment of the factors that influence women's university research careers. This assessment is being led by an Expert Panel on Women in University Research. To provide additional data to the Panel's analysis, the Council mandated a secondary analysis of data collected through a substudy conducted as part of the Canada Research Chairs program.[86] This document reports on that secondary analysis.

A5.2 DATA, QUESTIONS, AND STEPS

Data Reviewed

The Canada Research Chairs study aimed to identify systemic barriers to acquisition and retention of Canada Research Chairs in the four federally-designated employment equity groups: women, visible minorities, people with disabilities, and Aboriginal people. That this study would be conducted was a stipulation of the Settlement Agreement negotiated by the Canadian Human Rights Tribunal between the Canada Research Chairs Program and a group of complainants in October 2006. The Canada Research Chairs study included data from several sources:

- Questions on equity-related issues in web surveys conducted by Science-Metrix Inc. of:
  - Canada Research Chairs;
  - researchers holding other types of chairs;
  - researchers funded by one of the three granting agencies and not holding a Chair; and
  - university deans of research.

86 SSHRC, 2010. Study of Equity Issues – Evaluation of the Canada Research Chairs Program. Appendix to the Tenth-Year Evaluation of the Canada Research Chairs Program, Final Evaluation Report (Science-Metrix).

- Qualitative telephone interviews with 32 successful and unsuccessful applicants to the Canada Research Chairs program in the four designated groups (15 women, some of whom were also members of the other designated groups).

The qualitative components of all the data contributed by women, about women, and relevant to issues facing women, in the above sources were reviewed for the present analysis (whether or not the respondents were female). Permission was provided from SSHRC, the Agency responsible for the Canada Research Chairs evaluation, to use them for this purpose, under conditions ensuring confidentiality of respondents.[87]

Questions

The main question being addressed by the Council is: What policies and what societal, cultural, and institutional (e.g., universities, funding agencies), economic and/or other relevant factors (as determined by the Panel) influence the career trajectory of women researchers in Canadian university researcher's statistical profile, by discipline area, rank, duty/position/stature, salary, tenure, research funding and/or any other relevant indicators (as determined by the Panel)?

The question examined in this secondary analysis is a subset of that being addressed by the Council: What are the issues that women in university research may face as they seek to advance their careers, and do these issues differ across the range of discipline area in the natural sciences and engineering, social sciences and humanities, and health sciences?

To address this question, the review adopted the conceptual framework being used by the Council, where issues that may disproportionately affect women in university research related to the following factors were searched for:

- Family/community factors: time and emotional demands or family/home life, familial disruption for advancement, community ties
- Mentorship (or lack of): relationship with more senior academics, getting to know the ropes, the right people
- Social capital/schema: valuing by those in power of people like themselves (lack of social capital for those outside these schema)
- Research processes: types of research, demands of the types of research conducted

87 Email from Abderrahim El Moulat, SSHRC, to Isabelle Labrosse, Science-Metrix, 9.09.11

- Workload: rate of output production necessary to advance
- Grant programs: inherent limits to access due to features of the programs

Steps

The secondary analysis proceeded in the following steps:

Survey data

1. A single SPSS database with data on the equity questions from all on-line surveys conducted by Science-Metrix was created.
2. From all of the groups surveyed, all respondents were selected who had replied affirmatively to the questions below:
   - "Systemic barriers exist for women due to the way the Canada Research Chairs program is designed" or
   - "Systemic barriers exist for women due to the way the Canada Research Chairs program Chairs are awarded/administered at my university."
3. Their responses to the question: "Please describe these barriers" were then categorized as relating to the factors listed above. Within these responses, similar and divergent sub-themes were identified.

Interview data

Notes from the interviews with all respondents who discussed issues facing women were reviewed with the same framework. Material relevant to the themes emerging from the re-analysis of the survey data was identified to support or further illustrate those themes and incorporated into the survey data tables.

A5.3 FINDINGS

Respondent Characteristics

Table A5.1 shows the characteristics of the 161 survey respondents included in this analysis. This is 11 per cent of all survey respondents in the Canada Research Chairs evaluation.

Table A5.1

Characteristics of Survey Respondents in the Present Analysis

Category	Web survey N = 161	Interviewees N = 15*
Type of respondent		
Canada Research Chairs	123	15
Other type of chair	13	
Grantee	13	
VP Research	12	
Granting agency		
CIHR	41	
SSHRC	50	
NSERC	57	
Not specified	13	
Tier		
Tier 1	39	
Tier 2	83	
Not applicable/specified	39	
Region		
West (BC, AB, SK, MB)	53	
Central (ON & QC)	87	
Atlantic	18	
Not specified	3	
Total respondents		
Female	92	15
Male	31	
Not specified	38	

* Breakdown not provided to preserve confidentiality

Barriers Observed

Overview

To ensure respondent confidentiality, any identifying information for individuals, departments, or institutions has been removed.

Table A5.2 shows the relative frequency with which each of the types of barriers was identified among those who agreed that women face barriers in the Canada Research Chairs program. (Note that respondents could identify more than one barrier, and the results are collapsed across both questions: barriers in the design of the Canada Research Chairs program, and barriers in the award of the Canada Research Chairs.)

Table A5.2

Frequency of Types of Barriers Identified by those who Agree Women Face Barriers in the Canada Research Chair Program

Barriers identified	Number of respondents (N = 161)
Social capital/schema: valuing by those in power of people like themselves (lack of social capital for those outside these schema).	40
(Mentorship was merged with this category)*	14
Family/community factors: time and emotional demands or family/ home life, familial disruption for advancement, community ties.	32
Research processes: types of research, demands of the types of research conducted, that affect women more than men.	13
Characteristics of grant programs: inherent limits to access, or lack of oversight, from some programs/agencies.	10
Workload: rate of output production necessary to advance.	6

*The 14 respondents who mentioned mentorship are part of the 40 respondents counted in the social capital/social schema category. The text offers further explanation of why.

Social Capital/Schema Barriers

The types of barriers most frequently identified by respondents had to do with how the existing power and rewards systems are inherently conservative and self-protecting, which works against women because they are underrepresented in those systems. There were several themes that emerged from respondent's descriptions of the barriers they had faced or observed:

- **Dominance of white males in decision-making roles:** decision-makers who select people like themselves, resulting in perpetuation of embedded ideas about what good scholars and scholarship look like.

- **Emphasis on conventional successful career models:** in part because of the perpetuation of existing ideals described above, but also because these are less risky to the institution as it competes with others for funds or positions.
- **Lack of proactive process to seek non-dominant models:** lack of sensitization to the potential for discrimination and a lack of interest in the incentives to, or process for, redressing it.
- **Lack of support for, or valuing of, women in research:** some suggestion that deserving female scholars are not always as strongly supported by their institutions as are males.

Mentorship was a theme identified by the Panel. However, these data had no mention of mentorship as a positive factor for women researchers; rather, there were a number of mentions of how a negative form of mentorship — cronyism or old boys' clubs — have worked against women as they seek to advance their research careers. This category was thus subsumed into the "social capital/ schema" category:

- **Mentoring** (or lack of mentoring, or the fact that others have more access to it): exclusion of women from relationships with people in power or with influence on chair awards.

Barriers Related to Family or Community Responsibilities

Three main themes emerged from responses related to how family or other responsibilities create barriers to success in research careers:

- **Family and child care responsibility.** Impacts in reduced productivity, compared to male counterparts, of women's assuming a larger portion of family and child care responsibility.
- **Parental leave.** Reduced productivity and, hence, competitiveness associated with maternity leave. Several ways this factor operates were identified: a) career interruptions are not adequately factored in by selection processes, either in formal review processes or in informal scans drawing a department's or a university's attention to a possible candidacy; b) impacts on, and sometimes discrimination against young female researchers who are not integrated into research labs out of fear they will reduce the group's productivity.
- **Mobility factors.** Greater limits on mobility to take up positions elsewhere among women, or impacts on productivity as a result of women following their spouses.

Barriers Related to Research Processes

In this category were classified aspects of research work that engage or affect women differently from men. Two themes were present: a disproportionately higher number of women in some fields, that also received fewer Canada Research Chairs; and a tendency for women to be engaged in forms of research that are not as highly valued by the traditional academy.

Characteristics of Grant Program Requirements as Barriers: Lack of Equity Oversight

Another facet of the experience of women in accessing the Canada Research Chairs program is related to how the program was designed, specifically, that the nomination process was carried out by universities. Respondents mentioned that there has been a lack of oversight or reporting requirements from the granting agencies or from within the institutions to ensure that equity is addressed.

Workload Barriers

Responses classified into this category generally intersected with the family responsibilities issues already described; in that women were seen as disadvantaged in managing the same workload as men because of their greater investment in family and community responsibilities. However, an additional point was mentioned by respondents about administrative workload among female faculty.

Upstream Paucity

An additional underlying theme that was present in the responses is that of the "leaky pipeline" — there is a relative paucity of candidates for Canada Research Chairs and other prestigious awards because of upstream out-selection, well before the establishment of high-level research careers. This upstream issue, while critical, is only indirectly germane to the present study, which is focusing on women who are already pursuing research careers.

A5.4 CONCLUSION

This re-analysis of data collected for the Canada Research Chairs evaluation sought to contribute information to the question being asked by the Expert Panel on Women in University Research: What are the issues that women in university research may face as they seek to advance their careers?

Before summarizing the results of this analysis, we repeat the conclusions of the study on equity in the Canada Research Chairs program from which these data were drawn, to provide general context:

1. Some systemic barriers do exist for all four designated groups — women, visible minorities, people with disabilities, and Aboriginal people — in accessing and succeeding in the Canada Research Chairs program.

2. These barriers, while very real in some environments, are not rampant: they are reported by about 15 per cent of designated-status chairs (i.e., over all chairs in any of the four designated categories).

3. The barriers are both enabled and unchecked by some features of the way the Canada Research Chairs program and other Chairs programs are designed.[88]

This re-analysis, conducted through the analytical lens being used by the Expert Panel, found the most prevalent types of issues faced by women in university research, at least those in contact with the Canada Research Chairs program, are related to how women researchers are valued by those in power (i.e., senior administrators in universities making decisions about nominating faculty for chair positions, according them resources, and supporting and promoting them). There appear to be powerful social schema operating about what "model" or "star" researchers should look like, that may systematically exclude women from consideration and selection. There are also concerns about practices and approaches used by universities in locating and acknowledging brilliance that may leave excellent female researchers in the shadows. In general, these data suggest that not only is there a lack of incentive for institutions to address these barriers, there is a lack of sanctions and indeed some disincentives for them not to.

Family and community responsibilities are the second most prevalent issue reported by those who observed barriers to women's careers in terms of the Canada Research Chairs program. These include the demands of family's caregiving and duties on women's available work time that allow their male colleagues to have more opportunities to invest time in research. Some men also report experiencing these pressures against family life. They also include many issues around the counting, paying for and valuing of maternity leave, which is clearly problematic not just for women considering them, taking them, and coming back from them, but also

88 SSHRC, 2010. Study of Equity Issues – Evaluation of the Canada Research Chairs Program. Appendix to the Tenth-Year Evaluation of the Canada Research Chairs Program, Final Evaluation Report (Science-Metrix), p. 30.

for their colleagues and staff. These issues likely appear particularly acute for women being queried about the Canada Research Chairs program, because the age cohort of Tier 1 chairs is the one most directly affected by these questions. Family mobility is also an issue for many women researchers as they seek to advance their careers.

This analysis cannot comment on the particular exigencies of different disciplines that may affect women's career paths. However, the data do suggest that the denominator issue — differential distribution of genders across disciplines, coupled with differential chair allocations among disciplines — does indeed mean that women are disproportionately excluded from accessing Chair positions because of the disciplines where they have chosen to work.

In conclusion, this re-analysis supports the results of the previous study, that some women university researchers have and continue to face systematic gender-related barriers as they seek to advance their careers.

Assessments of the Council of Canadian Academies

The assessment reports listed below are accessible through the Council's website (www.scienceadvice.ca):

- Strengthening Canada's Research Capacity: The Gender Dimension (2012)
- The State of Science and Technology in Canada (2012)
- Informing Research Choices: Indicators and Judgment (2012)
- Integrating Emerging Technologies into Chemical Safety Assessment (2012)
- Healthy Animals, Healthy Canada (2011)
- Canadian Taxonomy: Exploring Biodiversity, Creating Opportunity (2010)
- Honesty, Accountability and Trust: Fostering Research Integrity in Canada (2010)
- Better Research for Better Business (2009)
- The Sustainable Management of Groundwater in Canada (2009)
- Innovation and Business Strategy: Why Canada Falls Short (2009)
- Vision for the Canadian Arctic Research Initiative: Assessing the Opportunities (2008)
- Energy from Gas Hydrates: Assessing the Opportunities and Challenges for Canada (2008)
- Small is Different: A Science Perspective on the Regulatory Challenges of the Nanoscale (2008)
- Influenza and the Role of Personal Protective Respiratory Equipment: An Assessment of the Evidence (2007)
- The State of Science and Technology in Canada (2006)

The assessments listed below are in the process of expert panel deliberation:

- Canadian Ocean Science
- Energy Prices – Impacts and Adaptation: Assessing Canada's Preparedness
- Food Security Research in Northern Canada
- Harnessing Science and Technology to Understand the Environmental Impacts of Shale Gas Extraction
- Medical and Physiological Impacts of Conducted Energy Weapons
- Socio-economic Impacts of Innovation Investments
- The Future of Canadian Policing Models
- The Potential for New and Innovative Uses of Information and Communications Technologies (ICTs) for Greening Canada
- The State of Canada's Science Culture
- The State of Industrial Research and Development in Canada
- The Sustainable Management of Water in the Agricultural Landscape of Canada
- Therapeutic Products for Children

Board of Governors of the Council of Canadian Academies[1]

1 Affiliations and Membership as at November 2012

Scientific Advisory Committee of the Council of Canadian Academies[2]

Tom Brzustowski, O.C., FRSC, FCAE, Chair
RBC Financial Group Professor in the Commercialization of Innovation, Telfer School of Business, University of Ottawa (Ottawa, ON)

Susan A. McDaniel, FRSC, Vice-Chair
Professor of Sociology and Prentice Research Chair in Global Population and Economy, University of Lethbridge (Lethbridge, AB)

Michel G. Bergeron, C.M., O.Q., FCAHS
Director, Division of Microbiology and le Centre de recherché en infectologie, University of Laval (Québec City, QC)

Murray Campbell
Senior Manager, Business Analytics Research, IBM T.J., Watson Research Center Yorktown Heights, (New York, NY)

Margaret Conrad, O.C., FRSC
Professor Emerita, Honorary Research Professor, University of New Brunswick (Fredericton, NB)

Marcel Côté
Founding Partner, SECOR Inc. (Montréal, QC)

Jean Gray, C.M., FCAHS
Professor of Medicine (Emeritus), Dalhousie University (Halifax, NS)

Judith Hall, O.C., FRSC, FCAHS
Professor of Pediatrics and Medical Genetics, University of British Columbia (Vancouver, BC)

2 Affiliations and Membership as at November 2012

John Hepburn, FRSC
Vice-President of Research and International, University of British Columbia (Vancouver, BC)

Daniel Krewski
Professor of Epidemiology and Community Medicine and Scientific Director McLaughlin Centre for Population Health Risk Assessment, University of Ottawa (Ottawa, ON)

Norbert R. Morgenstern, C.M., FRSC, FCAE
Professor (Emeritus), Civil Engineering, University of Alberta (Edmonton, AB)

John P. Smol, FRSC
Co-Director of the Paleoecological Environmental Assessment and Research Laboratory, Queen's University (Kingston, ON)

Robert Watson
Chief Scientific Advisor, Department for Environment, Food and Rural Affairs (London, United Kingdom)

Joseph D. Wright, FCAE
Retired President and CEO, Pulp and Paper Research Institute (PAPRICAN), (Gibsons, BC)

Council of Canadian Academies
Conseil des académies canadiennes

Council of Canadian Academies
180 Elgin Street, Suite 1401
Ottawa, ON K2P 2K3
Tel: 613-567-5000
www.scienceadvice.ca