DOCTORAL EDUCATION IN CANADA

1900-2005

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Armed with cutting edge technology from around the world, the latest tools, the latest techniques and processes learned from their work under the very best researchers, they graduate with much fanfare and go on to build the industry, institutions and society of our country.[1]

Mike Lazaridis
Founder, President and CEO
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Newly minted doctoral graduates, standing before the world with cap and gown at the center of convocation hall, have come to symbolize a university's quintessential contribution to the global knowledge-based society and economy in Canada today.

They represent our best hope for new discoveries and deeper understanding, for a proud place in the international intellectual community, for teaching future generations and, most especially, for national prosperity and well-being. As such, they marry the pursuit of knowledge, learning and world citizenship, on one hand, with national ambitions on the other. It is the interaction of these two forces, and the sense of importance accorded to each, that have shaped – and continue to shape – the scale and scope of doctoral education in Canada. Indeed, they must flourish or flounder together as all Canadian universities with doctoral programs are public institutions, publicly funded to serve public needs.

Yet there is no national system for supporting, governing and delivering doctoral education in Canada. Rather, the interaction of international intellectual currents and national ambitions has always been negotiated through three significantly autonomous institutions: universities, provincial governments and the federal government. Each brings different interests, resources and degrees of institutional variety and autonomy to bear on doctoral education, each affects the others and none is ever without influence. When and where universities play a predominant role, intellectual currents and local cultural, social and economic variations have shaped the overall structure of doctoral education in Canada. At those times and in those areas where provincial governments have exerted more influence, regional factors have been important while federal influence has tended to emphasize national social, economic and strategic interests. Thus, as doctoral education has evolved, growing in size and complexity in step with the country, the process has been uneven, shifting with the balance of influence between universities, provinces and the federal government, producing important variations among institutions and provinces over time.

This paper examines three periods in the evolution of doctoral education in Canada. It touches first on early developments, when limited government resources contributed to the formation of largely autonomous universities and important cultural, regional and local variations in the overall structure of doctoral education. It was at this time that universities established lasting responsibilities for developing public knowledge and providing higher education to serve Canada and the international community. At the same time, provincial governments established their jurisdiction over all postsecondary education and the federal government became involved in supporting advanced research. This arrangement of responsibilities has proven to provide a durable foundation for an ever-evolving relationship between universities, provinces and the federal government.

Following the Second World War, the relationship between universities, provinces and the federal government was significantly transformed, though not entirely revolutionized, by massive public investment in higher education and advanced research. Government investment at both levels dramatically expanded the scale and scope of doctoral programs, helping mitigate institutional variations in doctoral education nation wide. Although no single, planned or explicit negotiation took place between universities, provinces and the federal government at this time, both the new importance of public

funding and modest rearrangement of governance and training responsibilities came to be seen as essential parts of a tacit post-war social contract that is the subject of the paper's second section.[2] In a third section, the paper will examine the ways that universities, provinces and the federal government have all altered that tacit contract since 1980 in response to globalization before presenting, in a final section, a statistical portrait of doctoral education in Canada today that reflects much of its evolution over the past hundred years.

The Early Years: 1900-1950

In the eighteenth and nineteenth centuries, the interaction of international intellectual currents and colonial ambitions combined to inspire the creation of Canada's first universities: government chartered and assisted colleges affiliated with state sanctioned churches (the Roman Catholic Church in French Canada and the Church of England in English Canada).[3] In English Canada, however, the resentment of other churches, who quickly established their own affiliated colleges, spurred heated political debate that led colonial and, later, provincial governments to restrict support to autonomous non-denominational institutions. In the Maritimes this meant only two universities received public funding (one each in New Brunswick and Nova Scotia). In Ontario, it encouraged two colleges to secularize (Queen's University and the University of Western Ontario) and a few to federate in a large non-denominational provincial university (University of Toronto). The western provinces applied this principle too, each providing support (using public lands) to a single non-denominational university. Political interference in these institutions continued to produce controversy, however, until 1906 when a scandal at the University of Toronto prompted the Ontario government to establish a separate Board of Governors (responsible for university finances) and Senate (responsible for academic affairs) for the institution. This governance structure provided a good measure of autonomy for the institution and a minimum of controversy for the politicians. As a result, it was quickly copied in all provinces.[4]

In all institutions – even the non-denominational ones – religious influence in the intellectual community encouraged the introduction of different academic traditions in the eighteenth and nineteenth centuries. Presbyterian colleges (notably Dalhousie, Queen's and McGill Universities) placed an emphasis on practical skills and science borrowed from the Scottish tradition of higher education.[5] In most other institutions, English and French traditions of reflective study and undergraduate teaching or the emphasis of American land grant universities on teaching and professional training dominated. Consequently, research, graduate training and doctoral education did not play a significant role in Canadian universities until the country, and intellectual community, began to change at the turn of the last century.

Between 1880 and 1914, immigration, western expansion, industrial development and the concentration of capital and people in Montréal and Toronto signaled the beginnings of a more modern, socially complex and economically integrated Canada. These changes coincided with the introduction of social and physical sciences, disciplinary specialization and research in the international academic community. Combined, these international and national developments made the University of Toronto and McGill University in Montréal particularly fertile grounds for the introduction, via the influence of Johns Hopkins University, of the German ideal for the university as a centre of scientific research and graduate training, stimulating and supporting industrial development and economic growth. The University of Toronto awarded the first Canadian doctorate in 1900, in physics, while McGill University conferred its first doctorate, in the natural sciences, in 1909. These two institutions awarded the majority of Canadian doctorates before the Second World War.[6]

Although the number of doctoral graduates doubled in both the 1920s and 1930s, these remained, very few.[7] Most Canadian PhDs trained in the United States or Britain and nearly half of all Canadian graduates found work outside the country.[8] Most public support for research and research training came indirectly from small provincial grants to the few non-denominational universities. A precedent was set, however, during the First World War for federal involvement in higher education, advanced research and doctoral training. In 1916, as part of the war effort, the federal government established the National Research Council (NRC) to fund industrial research. The NRC provided the first publicly funded research grants and doctoral fellowships in Canada and established federal jurisdiction over advanced research as part of its responsibility for economic development.[9]

Thus, by 1950, universities had established their responsibilities for conducting and managing higher education, advanced research and doctoral training. As largely autonomous, predominantly independent, institutions with limited public funding, their particular

cultural traditions and local communities shaped them and their reaction to intellectual currents. Provinces had clearly defined responsibilities for chartering universities and, within specific limits, funding higher education while a small federal role in advanced research had been accepted. As a result, there was considerable variation in the funding, governance and conduct of higher education and research from one institution to another and very little doctoral study.

The Post-War Era: 1951-1980

The Second World War, and the economic and demographic booms that followed, significantly altered the scale and scope of doctoral training by encouraging much greater federal and provincial investments in postsecondary education and advanced research. Close collaboration between university researchers and the federal government during the war years proved the strategic and economic importance of scientific research. After the war, the contribution of advanced research to industrial development provided yet another argument for increased public investment. The wartime experience also reinforced a sense of obligation to create opportunities for veterans, the baby-boom generation and all who wanted to pursue higher education. This new sense of the public interest inspired new funding, new funding mechanisms and, ultimately, new governance and management structures that came to be seen as parts of a tacit social contract between universities and the two orders of government.

During this time, the success of universities in meeting public expectations, and the governance model applied to publicly funded institutions, helped them retain their autonomous status and influence over postsecondary education and research. In fact, it was at the urging of the National Conference of Canadian Universities that the federal government, acting on its responsibility for economic development, first increased public support. It introduced direct grants to universities in 1951, increased funding for the National Research Council, established the Canada Council for the Arts (1957) and created the Medical Research Council (separating it from the NRC in 1960).[10] All of these initiatives encouraged the development of doctoral programs either directly, through the creation of doctoral fellowships, or indirectly, through support for institutions and provisions that encouraged professors to employ graduate students as research assistants. The federal interest in industrial and strategic research was apparent in the allocation of greater support for science, engineering and medical research than the humanities or social sciences (even keeping in mind that research costs are higher in those fields).[11] Within these parameters, however, universities ensured that federal funding agencies functioned at "arm's length" from Parliament. For the most part, these agencies awarded fundamental and strategic research grants, and doctoral fellowships (approximately a third of their budgets), on the basis of peer review. In this way, they preserved a significant measure of institutional autonomy and a balance between academic interest and national ambitions.

When the first baby boomers reached university age in the 1960s, public interest in postsecondary education and business demand for an educated workforce made access to higher education and university expansion a provincial as well as a national and institutional priority. Within fifteen years, from 1960 to 1975, public funding increased universities' operating expenditures nationwide by 1,000 per cent.[12] By limiting public support to non-denominational institutions, provincial governments produced rapid change in the governance structure of most colleges. Almost overnight, impoverished religious institutions secularized to serve changing public needs and access public funding. Small colleges amalgamated to form large non-denominational universities and, where no colleges existed, entirely new institutions sprang up in large and small communities. Provincial funding also brought provincial policies governing tuition fees and other measures affecting public access to postsecondary education. As a result, the contribution of student fees to university operating expenditures declined from 25 per cent to 14 per cent nation-wide despite a huge enrolment increase. [13]

At the national level, the federal government was forced to reconcile its initiatives with provincial responsibility for postsecondary education. It replaced direct grants to universities with conditional transfers to provincial governments in 1967 (1959 in Québec) and, in 1977, introduced an Established Program Financing arrangement that gave all provinces funds to use at their discretion for medicare, hospital insurance and postsecondary education. The same year though, it solidified its role in advanced research by creating the Natural Sciences and Engineering Research Council (out of the NRC) and the Social Sciences and Humanities Research Council (out of the Canada Council for the Arts). Thus, by the 1970s, a dramatic transformation had taken place in funding for higher education and advanced research in Canadian universities

and both levels of government played more prominent roles in the governance and administration of funds. Yet universities retained considerable autonomy and much of their control over the content and conduct of higher education and research.

As in the past, Canadian universities turned to British, American and French university graduates to fill their new teaching positions.[14] These scholars, all professionally trained researchers, formed graduate faculties to distinguish themselves from less qualified professors. Within these faculties, they adopted training practices that combined both the American tradition (emphasizing substantial course work) and the British and French traditions (emphasizing a long period for original research and a lengthy thesis). Generally, graduate faculties accepted students upon the recommendation of a particular department. In most universities, young Canadian doctoral students paid low tuition fees that were reduced after completion of a residency requirement, course work and a comprehensive exam in the first year or two of the program. Most had seven years (after an M.A. or M.Sc.) to complete their degrees, demonstrate proficiency in a second language and defend their theses before committees of departmental professors with one outside examiner.

Students flooded into these new or newly enlarged doctoral programs in the 1960s. The number of graduate students rose from 6,518 in 1960 to 40,108 in 1975. In 1960, 0.9 per cent of Canadians aged 22-24 had enrolled in graduate programs; fifteen years later, 3.3 per cent pursued graduate studies.[15] Canadian universities conferred 306 doctoral degrees in 1960. Ten years later, they conferred 1,680 and enrolled 13,268 doctoral candidates in programs across the country.[16] Fourteen universities, in twelve different cities, each enrolled as many doctoral students in 1971 as the entire country had produced a decade earlier. Clearly, increased public funding made it possible for more institutions to offer doctoral programs or expand existing programs. By mitigating some of the differences between institutions in smaller centers and those in larger cities, in this way, federal and provincial governments had increased educational opportunities and research nation-wide.

Despite this remarkable growth, however, no single postsecondary education or doctoral training system emerged. Institutions continued to vary as a result of their autonomous status, different scholarly traditions, different sizes and access to private resources as well as the particular needs of their local communities.[17] In 1971, the University of Toronto and McGill University still boasted the largest doctoral programs in Canada. The five largest universities (including the University of British Columbia, the University of Montréal and the University of Alberta) trained 53.5 per cent of all doctoral candidates.[18] Ten years later, the same universities taught 55.1 per cent of all Ph.D. students in Canada.[19] Within their borders, provincial governments mitigated some of these differences by providing equal funding for each student, setting common tuition levels and providing student assistance. Yet these measures also reinforced existing institutional, provincial and regional differences. For example, the number of graduate students choosing to study at universities in eastern and western Canada remained well below those provinces' share of the national population; while the number of graduate students choosing Ontario universities remained well above and actually grew faster than its share.[20] So, while public spending transformed the scale and scope of doctoral education in Canada by reducing differences between universities, persistent institutional and provincial variations remained.

In much the same way, the arrangement of responsibilities between universities, provinces and the federal government for funding, governing and conducting higher education and advanced research had been transformed by public funding into a tacit social contract that preserved essential elements of earlier arrangements. The federal government targeted funds to broad areas of national interest but limited its direct support to advanced research and research training. With the assistance of federal transfers, the provinces increased spending on postsecondary education and took greater control over university tuition but still provided the bulk of public funding for higher education and directed it exclusively to non-denominational institutions. Universities' influence in society and governance structures helped them retain much of their autonomous status as unique institutions with their own traditions and private resources, serving particular communities, managing the delivery of education and the conduct of research.

The Global Era: 1981-2005

The arrangement of responsibilities between universities, provinces and the federal government changed again in the 1980s as intellectual currents evolved and a global economy altered national ambitions. The new economy, spurred by the growth of multinational corporations, greater movement internationally and a revolution in

communications technology increased production and intensified economic competition worldwide, placing a premium on market knowledge, innovation and intellectual property. It also produced a worldwide recession in 1981-82 that dramatically altered Canadian perceptions of their economic, social and political circumstances. After years of persistent inflation and unemployment in the 1970s, the recession provided conclusive evidence that post-war government policies were no longer able to assure prosperity and social stability. Canadians increasingly turned away from government and towards individual initiatives to build their society. They encouraged governments to curtail their activities, reduce public spending, decrease taxes and assist in attracting foreign capital. These same developments, combined with exponential growth in advanced research and increased specialization within academe, raised new research problems that crossed provincial and national boundaries as well as disciplinary distinctions. Thus globalization altered both the context and substance of university education, advanced research and doctoral training in Canada.

Both contextual and substantial changes were negotiated through federal, provincial and institutional policies and programs. The federal government, whose role in postsecondary education and research was most closely tied to national economic policy, played a leading part by altering the means through which universities and doctoral programs might contribute to national prosperity. Provincial governments, concerned with the cost and quality of university education sought to increase flexibility and planning within their postsecondary education systems.[21] They began to appreciate the role that research played in their own economies too and started or expanded their own programs for university research and research training. Finally though, it was the direct influence of globalization on universities themselves that had the most dramatic effect on doctoral education. Growing numbers of people sought advanced degrees and communities sought greater access to advanced research while faculty and graduate students struggled with new issues, new methodologies, costly new technologies and increasingly interdisciplinary and international research projects. Universities increasingly turned to students and the private sector for support. Thus universities, provinces and the federal government each altered the social contract between them in response to globalization, rearranging yet again their collective responsibilities for funding, governing and conducting higher education, advanced research and doctoral studies in Canada.

(a) Federal funding and the new national interest

Federal adjustment to the new global economy took place in two distinct phases. From 1980 to 1997 the government unilaterally altered its tacit agreement with universities and the provinces by reducing support from postsecondary education and university research.[22] It began, in 1980, by capping Established Program Financing (EPF) for postsecondary education and by revising this system of cash and tax-point transfers to the provinces in a way that would have eventually eliminated any real transfer (while still providing some justification for claims that it contributed to postsecondary education). Then, in 1995, it replaced the EPF system with the Canada Health and Social Transfer, imposing further reductions while freeing the provinces to spend these funds as they saw fit (dropping any pretense that part of the transfer was targeted for postsecondary education). The federal government also reduced its direct support for advanced research and doctoral training, provided through the granting councils, in these years. The number of doctoral fellowships available to Canadians fell and so did registration in d octoral programs.[23] Neither funding nor registration was restored until the government reduced its deficit to zero.

In 1998, the second phase in federal adjustment to the global knowledge-based economy began as the government sought to build an economic advantage for Canada through major investments in university-based research and research training. According to then Finance Minister, Paul Martin, *"there can be few things more critical to determining our economic success in the next century than a vigorous, broad-based research and development effort. The fact is the more R&D that is done in Canada, the more jobs will be created for Canadians."* [24]

Recognizing, like other major industrialized countries, that technological change, larger markets and increased competition made market knowledge and innovation more important factors in economic success, the government made a series of major investments to increase the production of new knowledge and the training of highly qualified researchers in Canadian universities. However, after imposing severe restraints on all sectors of society in order to reduce its deficit, the government was no longer willing to simply assume that investment in postsecondary education, research and research training would produce long-term benefits.[25] Thus it altered other parts of the tacit post-war social contract by increasingly targeting funds to areas of national economic interest, demanding a demonstrable return on investment, greater transfer of knowledge outside

academe, matching funding from other sources and higher levels of accountability.

The federal government first adopted this approach in 1989, in fact, when it created the Networks of Centres of Excellence (NCE) program (based on a similar program in Ontario). The program required close collaboration between researchers and industry; but it also sought to advance new research methods, emphasizing interdisciplinary and inter-provincial team research, much like major collaborative research initiatives established at that time by the granting councils. Such programs enriched doctoral studies by exposing students, as members of large research teams, to a wider range of expertise, improved facilities and better financial support.[26] In 1997, it set up the Canada Foundation for Innovation (CFI) to fund research infrastructure in partnership with universities and provinces. The 1998 federal budget restored funding to the granting councils and established the Canadian Millennium Scholarship Foundation as well as other measures to assist students with the cost of higher education. In 2000, the government created Genome Canada, greatly expanded and transformed the Medical Research Council into the Canadian Institutes of Health Research (CIHR) and launched the Canada Research Chair (CRC) program to attract foreign scholars, repatriate Canadian researchers and retain academic leaders in Canada. The CRC program significantly strengthened doctoral education by providing infrastructure and research support to funded scholars. In 2001, the government made a direct contribution to universities in order to offset the indirect costs of federally funded research (a contribution established permanently in 2003).

Each of these initiatives altered the federal role in postsecondary education and research. They improved doctoral education by providing more students with better facilities and greater opportunities for funding, learning and career development. But, by insisting on greater knowledge transfer outside of academe, they also raised concerns over the control and ownership of research that universities and granting councils have just begun to address. At the same time, they further differentiated between students in the sciences, engineering and medical fields and those in the social sciences and humanities by increasingly targeting federal funds to the former. It was not until 2003, that the government provided direct support for graduate education in a way that addressed some of these concerns. That year the federal government created the Canada Graduate Scholarship (CGS) program to fund 2000 masters and 2000 doctoral fellowships annually. The program increased the number of federal fellowships by 70 per cent (to almost 10,000) and, for the first time, supported a greater number of students in the social sciences and humanities than other disciplines (60 per cent). Yet the national economic interest was still foremost in the government's mind. In the words of Minister Martin,

"*The most precious commodity in today's economy is knowledge. We have invested heavily in postsecondary education and in excellence in university research. We believe that our future lies in providing young Canadians with the best education possible, with the best universities that produce the best knowledge and the best graduates, and with an education system that can compete with the best in the world.*"[28]

As a result, the government limited CGS scholarships to Canadians studying in Canada (a departure from other federal fellowships that allow Canadian students to attend foreign institutions). Moreover, it still has no plans to attract foreign students by allowing them to hold CGS scholarships or work while studying in Canada.

(b) Provincial governance and the global market for ideas

Provincial governments faced many of the same economic, social and political pressures as the federal government in the 1980s and 1990s. So, when the federal government withdrew support from postsecondary education, research and research training, the provinces generally responded by reducing their level of funding to universities and by seeking new ways to improve the efficiency and accountability of their postsecondary institutions. Overall government spending on universities declined 4.5 per cent despite an 18 per cent increase in university enrollment.[29] Public contributions to university operating budgets declined from 81 per cent, in 1986-87, to 61 per cent in 2000-01.[30] These reductions altered the social contact by shifting part of the financial burden for postsecondary education and research back onto individuals and the private sector. Moreover, they increased competition between provinces and between universities in ways that quietly accepted, for the first time in thirty years, differences based on their own resources and policy choices.

Provinces with resources and a political will to compete in the intellectual market started to differentiate themselves from those who did not. Québec, which had established its own system of research granting councils in the 1960s, already had a noticeable advantage on

which to build. In the 1980s, Ontario launched a Centres of Excellence program and other targeted initiatives while Alberta directed support from its Heritage Fund to university research.[31] All three provinces sought to complement federal research funding, encourage the application of research results and support an intellectual shift towards interdisciplinary team research. As a result, doctoral students increasingly chose to study in Québec, Ontario and Alberta. Because all doctoral programs in those provinces benefited, this trend actually reduced the degree of concentration within the largest universities, but it did nothing to spread doctoral students across the country.[32] In Manitoba, where the provincial government chose to invest more heavily in community colleges, the University of Manitoba saw the size of its doctoral program, eleventh largest in 1981, decline to seventeenth in 2001.[33] By then the University of Saskatchewan and Dalhousie University had also dropped out of the top fifteen leaving only one institution among that select group (the University of British Columbia) outside of Ontario, Québec and Alberta.

At the same time that globalization, and the federal reaction to it, increased the market influence on provinces and universities, it also increased the movement of people and ideas across international borders in a way that transformed the intellectual community as well as the market for students and researchers. These national and international trends combined, in the 1980s and 1990s, to encourage greater institutional and provincial interest in quality assurance. Since the 1960s, Ontario universities had worked with the provincial government in the Ontario Council on Graduate Studies to assure educational quality at the graduate level. But, as they entered increasingly competitive national and international markets, all universities went farther to strengthen their internal, regional and national evaluation processes. With respect to doctoral programs, international comparisons, concern for student success and increasing costs prompted a renewed focus on "time-to-completion" in particular.[34] In 1990, universities formed a national body, the Canadian Institutional Research and Planning Association, to advance research on post-secondary education and improve methods of assessing the effectiveness and efficiency of postsecondary institutions. When John Evans, President of CFI, called for a more explicit social contract between universities and the federal government in 2001, universities took the lead in drafting a proposal.[35]

Like universities, provincial governments also increased their interest in quality assurance in response to international and national pressures. In 1990, when Canada ratified the 1979 UNESCO Convention on the Recognition of Studies, Diplomas and Degrees concerning Higher Education in the States belonging to the European Region, they joined the federal government in establishing the Canadian Information Centre for International Credentials and now maintain the Centre themselves. More recently, provincial decisions to allow private and out-of-province higher education providers prompted the formation of provincial quality assessment boards in Alberta, Atlantic Canada, British Columbia and Ontario.[36] These boards are all members of the International Network of Quality Assurance Agencies in Higher Education and came together, in 2005, under the auspices of the Council of Ministers of Education of Canada to establish a Pan-Canadian Committee on Quality Assurance. There is some debate now over who, universities or governments, should take the lead on quality assurance in Canada and over what, institutions or academic programs, should be assessed. But Ontario universities recently embraced a version of degree level standards proposed by the Pan-Canadian committee, a step that augurs well for future collaboration and, possibly, an accepted "amendment" to the tacit social contract addressing quality assurance issues.[37]

(c) Canadian universities in the international community

In the 1980s and early 1990s, universities often found themselves caught between declining government funding and rapidly rising enrolment. Despite a decline in the traditional university-aged population in Canada, overall university enrolment increased by 30 per cent as Canadians and foreign students sought advantage in the new economy.[38] Enrolment in graduate programs increased 66 per cent while the number of doctoral candidates rose 106 per cent nation-wide.[39] The number of foreign students enrolled in graduate programs increased even more dramatically, rising 168.8 per cent in the 1980s. The proportion of foreign students in Canadian graduate programs increased from 12.3 per cent in 1981 to 22.8 per cent in 1991 and 26.4 per cent in 2001.[40] It stood even higher in doctoral programs, at 33.9 per cent, in 2001.[41] During this time, the participation of women in doctoral studies also increased, from 36 per cent in 1991 to 46 per cent in 2001.

Universities met this demand, in the face of government cutbacks, by reducing program, faculty and staff costs, deferring maintenance on their classrooms, laboratories and physical plant, and by increasing their private sources of revenue.[42] Most important among these were tuition fees, which provinces allowed to increase 135 per cent, on average, between 1986-87 and 2000-2001.[43] During that time, most universities also introduced differential fees for most international students. Some provinces (notably Ontario) also allowed universities to eliminate a long-standing post-residency reduction in tuition fees for doctoral candidates. Overall, the proportion of university operating revenues derived from tuition fees increased from 16 per cent to 34 per cent.[44] But universities also raised their revenues from bequests, donations and private sector grants as well as contracts, spin-off companies and licensing agreements to double the proportion of their revenue from all private sources to 39 per cent.

These changes to university finances increased differences between institutions in two ways. They increased variations between universities in different provinces as each province adopted different tuition fee policies in addition to providing different levels of direct support. British Columbia, Manitoba, Newfoundland and Québec limited tuition fee increases to facilitate student access to higher education while others allowed fees to rise to help cover university expenditures.[45] But it also became clear that individual institutions had varying capacities to raise other private revenues. Smaller institutions in smaller centres absorbed more of the enrollment increases in the 1980s and, as a result, saw their operating revenues increase more than larger institutions.[46] But their expenditures increased, they received slightly less provincial government support per student than larger institutions and had more difficulty securing private sector and federal government research funding. Conversely, universities in larger, growing and prosperous cities benefited. Most notably, the size of the doctoral program at the University of Calgary moved from fifteenth in the country in 1991 to tenth as that city grew from the nation's sixth to fourth largest by 2001.[47]

But globalization also produced substantive changes in doctoral education itself as students, supervisors and universities become increasingly integrated into international intellectual communities. By pursuing new issues and interdisciplinary research, students and supervisors developed new methodologies, created new knowledge and understanding, redefined disciplinary boundaries and challenged traditional departmental procedures. Universities accommodated and encouraged interdisciplinary research by allowing students to take courses and include supervisory committee members from outside of their department.[48] Some allow doctoral students to enroll jointly in two departments while others have experimented with a multidisciplinary college within the graduate studies faculty. Such interdisciplinary training is now often reflected in the degree conferred. As interdisciplinary research takes students across provincial and national boundaries, universities have sought ways to facilitate graduate student mobility. The Canadian Association of Graduate Studies (CAGS) recently negotiated an agreement, endorsed by all institutions, to provide access to graduate programs, supervisors, libraries and laboratory facilities for students from other Canadian universities. To bring the agreement into effect, CAGS is seeking support from the federal government for student travel and any differences in registration and housing costs from those at their home institution. CAGS hopes to extend this agreement internationally and secure permission both for Canadians to carry Canada Graduate Scholarships abroad and for international students to hold similar awards in Canada.

At present, international mobility still depends on individual institutional arrangements and, as a result, is often influenced by linguistic and other cultural variables that continue to shape the intellectual community. These differences are particularly obvious in Canada because of the development, exclusively within Francophone universities, of "co-tutelle" agreements with institutions in France. These agreements are negotiated separately for each student and make it possible for them to receive training at two institutions. Students must meet the requirements of both institutions to receive a degree that reflects the contribution of each. Recently, the Bologna process has helped Francophone universities negotiate such agreements with institutions outside France by increasing the structural similarity of European universities (one of the few direct influences of the Bologna process on Canadian institutions). But there is still no equivalent for students in Anglophone universities.

Today, the challenge for universities, provinces and the federal government is to make "amendments" to the tacit social contract between them, to strike a new balance, that recognizes the changes each has introduced in response to globalization and addresses the challenges that remain. That process of arranging and rearranging

responsibilities is already more than a hundred years old. It's foundations, set long ago, remain strong and the post-war era has left an enduring legacy in the existence of doctoral programs across the country. Building on those foundations, doctoral education has thrived in the global era. But the effects of this long, continuing and uneven process are evident in the portrait of doctoral education today.

Doctoral Education Today

(a) An urban phenomenon

In 2001, Canadian universities conferred a record number of doctoral degrees (approximately 3,660 - an increase of almost 40 per cent since 1991) and were engaged in training a record number of doctoral candidates.[49] There were 27,340 doctoral students that year (0.9 per thousand population), more than double the enrollment in 1981. Most of the growth came in the 1980s as from 1995 to 1998 the decline in government funding for postsecondary education, research and research training contributed to small decline in the number of students pursuing doctoral studies in those years.

The regional distribution of doctoral students reflects the lack of a single coordinated national approach to funding, governing and conducting doctoral education in Canada and the commensurate importance of urban centres, institutional strength and provincial investment. Fully 71 per cent of doctoral candidates studied in Ontario (39.9 per cent) and Québec (31.1 per cent) in 2001; in both cases, these figures are higher than their shares of the Canadian population (Ontario represents 38 per cent of the total Canadian population while Québec represents 24.1 per cent).[50] Alberta, as a result of significant provincial investment, is the only other province to capture more than its share of doctoral students (with 10.5 per cent of doctoral candidates and 9.9 per cent of the population). British Columbia attracts close to its share of students (11.2 per cent, relative to 13.0 per cent of the population) while the other provinces fall short *(see table 1)*.

The particularly urban and institutional influence on the concentration of doctoral studies is even more evident in the distribution of doctoral students by city. Fully 50.6 per cent of all doctoral candidates study in one of Canada's three major urban centers (Montréal 21.2 per cent; Toronto 19.7; Vancouver 9.7) while another 33.2 per cent study in other large cities (Edmonton 7.2 per cent; Québec City 6.1; Ottawa 5.2; Calgary 3.2; London 3.2; Waterloo 2.8; Hamilton 2.7).[52] Only the historic Queen's University, in Kingston, Ontario, stands out as an institution located outside of an important urban center that educates a significant percentage of Canadian doctoral students (2.8 per cent). Although 91 institutions are chartered to confer university degrees in Canada, only 46 enrolled doctoral students in 2001.[53] Of these, one third (15 universities) graduated 79.9 per cent of all doctoral candidates; six universities trained more than half (51.9 per cent of all candidates); while the University of Toronto alone trained 15.9 per cent (almost double the next largest university).

Table 1 – Doctoral Candidates and Provincial Population, 2001.[51]

Province	PhD Students (no)(%)		Population (%)
Ontario	10,900	39.9	38.0
Québec	8,510	31.1	24.1
British Columbia	3,050	11.2	13.0
Alberta	2,860	0.5	9.9
Manitoba	545	2.0	3.6
Saskatchewan	480	1.8	3.2
Nova Scotia	445	1.6	3.0
New Brunswick	270	1.0	2.4
Newfoundland	255	0.9	1.6
Prince Edward Island	10	0.4	0.4

(b) Broad interests - Targeted support

The majority of doctoral students (50 per cent in 2001) pursued degrees in the social sciences and humanities (including education, arts and communication, business, management and public administration).[54] Students in the sciences and engineering accounted for 43.1 per cent of doctoral enrollment while students in the health sciences made up 6.2 per cent of all doctoral candidates. During the 1990s, enrollment increased significantly in business, management and public administration (69.5 per cent), arts and communications (65.5 per cent), health sciences (38.2 per cent), social sciences (17.9 per cent) as well as the physical and life sciences (8.7 per cent); in absolute terms, however, the greatest increase was in the social sciences. Enrollment in the humanities declined (by 8.9 per cent), largely in the later half of the decade; while enrollment in engineering, architecture, mathematics and computer sciences declined during the years federal funding was reduced (1995-98) before rebounding once funding was restored.

To fund their studies, doctoral candidates rely on four different sources of funding: the university, their own resources, the federal government and their province (in that order). For all, the most common source of funding is the university. Fully 64 per cent of recent graduates reported income from university teaching assistantships, 58 per cent from university scholarships and 30 per cent from university research assistantships.[55] Personal savings were reported as a source of funding by 39 per cent of all students, personal earnings by 33 per cent, family earnings by 31.5 per cent and loans by 27.3 per cent. Federal fellowships were reported by 35.2 per cent of all students and federal research assistantships by 18 per cent. Provincial fellowships were reported by 36 per cent. Most importantly, though, institutions and governments provided the largest part of most students' budget. Fully 71.4 per cent of doctoral graduates indicated that fellowships (51.6 per cent) and assistantships (19.8 per cent) from all sources represented their primary source of financing while 23.1 per cent relied principally on personal resources of all kinds (3.8 per cent of which were loans).[56]

But government support is not equally distributed among doctoral candidates. A greater percentage of life sciences students (agricultural, biological and health sciences) (66 per cent) and science students (57 per cent) draw on fellowships as their primary source of funding than students in engineering and the social sciences (50 per cent), the humanities (43 per cent) or any other field (26 per cent).[57] As a result, 68 per cent of students in the sciences and engineering graduated without any debt directly related to their graduate education.[58] This was true of 56 per cent of students in the life sciences and approximately 45 per cent in the social sciences and humanities. Of all those students carrying debt related directly to their doctoral studies, one third reportedly owed over $20,000 while 41 per cent owed less than $10,000.[59] Students in the humanities, followed closely by those in the social sciences, carried the heaviest debt loads.

Given the importance of government and institutional financing for doctoral students, it is not surprising to find that policies encouraging scientific and engineering research have had considerable impact on the distribution and success of doctoral students across disciplines in Canada. Fully 43 per cent of doctoral students are enrolled in the sciences and engineering as compared to only 21 per cent of bachelors and masters level students.[60] Whether related to funding, or other issues, social sciences and humanities students also have the lowest completion rates (averaging 45-50 per cent compared to approximately 75 per cent in other disciplines) and the highest average age at time of completion.[61]

(c) Quality and interdisciplinarity

The interaction of intellectual and national ambitions has also influenced doctoral programs themselves, and student experience within them, in recent years. By emphasizing funding for the health and physical sciences, government supports reduce the need for those students to work outside of their studies, provide greater access to intellectual and material resources, and contribute to shorter times to completion as well as higher rates of completion. On average, it took doctoral students in Canada 5 years and 10 months to complete their studies.[62] However, while all required more than five years to graduate, only social sciences and humanities students required six years or more. Graduate schools have worked hard to reduce times to completion. In a 1994 survey, doctoral supervisors and department heads identified careful student selection, student motivation, financial support, supervision, project planning and a period of full time study as significant factors in reducing the time to completion for doctoral students.[63] Conversely, they noted that most students who did not complete their studies left because of a lack

of financial support, poor supervision or inadequate project preparation. All have been the subject of programmatic reforms in recent years.

Over the past fifteen years, universities have also restructured doctoral programs in order to provide intellectual experience and research training across a wider range of fields. For example, the University of Toronto now offers 36 collaboratory or interdisciplinary programs. The University of British Columbia offers 11 interdisciplinary programs and one multidisciplinary unit (Green College). Universities with smaller doctoral programs also offer interdisciplinary training opportunities such as the individual and personalized programs offered by the University of Manitoba and Simon Fraser University. These programs provide interdisciplinary experience by encouraging students to pursue courses outside of their discipline or by including professors from more than one discipline on a supervisory committee or examination board. Each of these measures helps students explore new intellectual issues and integrate new research methods into their work.

(d) A diverse student community

Over the course of the 1990s, full time enrolment in doctoral programs increased from 82.2 per cent of all students in 1990 to 89.6 per cent in 2001 with a significant increase (3.4 per cent) in 1998.[64] That year the first members of the baby-boom "echo" generation might have qualified for doctoral studies and the federal government restored funding to the granting councils. Part-time enrolment decreased in all fields in the 1990s except in engineering and architecture where the percentage of part-time students remained small and largely unchanged. Part time students are almost always older and include more women (60 per cent).[65] Including master's level students, one quarter are in the 20-29 year old age group, 40 per cent in the 30-39 year old age group, and 30 per cent are forty or older.[66] Over all, the average age of all full and part-time doctoral graduates, upon completion of their degrees, was 36 years old with 20 per cent in the 20-29 year old cohort, 24 per cent over 40 years old, and the remainder in their thirties.[67] Students tended to be oldest in education (46 years old on average) and younger in the sciences (31 years old in chemistry).

The majority (53.9 per cent) of all doctoral students are men.[68] Over the last decade, however, the number of women pursuing doctoral studies has increased steadily. In 2001, women represented 46.1 per cent of all doctoral candidates whereas they represented only 35.5 per cent in 1991.[69] Moreover, seven of the ten universities with the largest doctoral programs, including the four largest, enroll more women than the national average.[70] Women represent 31.3 per cent of doctoral candidates in science and engineering, 57.2 per cent in the social sciences and humanities, and 57.9 per cent in the health sciences (the field in which women's participation has increased most significantly in the last ten years).[71]

Foreign student participation in Canadian doctoral programs rose dramatically in the 1980s and early 1990s before peaking, in 1993, at 10,045 or 37.9 per cent of total student enrollment. It fell, during the years of reduced financial support for advanced research, to 8,775 or 33.1 per cent in 1998.[72] Those numbers increased slightly, with funding, to 33.9 per cent in 2001, the last year for which national data is available. However, there is some evidence from universities that foreign student enrollment has increased since then, possibly, as a reaction to American immigration policy following the events of September 11, 2001. This sensitivity to national and international forces reflects the influence of globalization on doctoral training and presents a challenge, for institutions and policy makers, who must react quickly with imperfect information.

The distribution of foreign students, and their significance in doctoral programs, is not even across the country. In 2001, fully 64.3 per cent of all foreign students registered in one of the ten universities with the largest doctoral programs in Canada, a level of concentration very similar to that of Canadian students. However, only four of those ten universities enrolled more foreign students than the national average.[73] For the most part, smaller institutions in the Atlantic and western provinces attract a greater percentage of their doctoral students abroad. Foreign students are predominantly male (approximately 75 per cent) and are more common in the sciences and engineering (fields that attract approximately 75 per cent of all foreign students.)[74] They represent 45.6 per cent of all students in the sciences and engineering, 25.4 per cent in the social sciences and humanities and 24.1 per cent in the health sciences.[75]

(e) Employing expertise

Most students (75 per cent) make firm plans to work or pursue further study during their doctoral program. Of these, a majority arranges employment (56 per cent) while a significant number (approximately 44 per cent) plan for postdoctoral (34 per cent) or other formative training (10 per cent).[76]

In general, a majority of students in the health and other sciences pursue further studies and are encouraged to do so by government support for research in their disciplines. Almost all graduates, in all disciplines, who pursue further study take up postdoctoral fellowships offered by granting agencies (50 per cent) or universities (25 per cent) and continue to work in a university setting (87 per cent).[77]

A majority of students in the humanities, social sciences and engineering seek employment. Of all graduates, in all disciplines, who pursue employment, 57 per cent will work in the educational services industry with 13.4 per cent working in professional, scientific and technical services, 10.6 per cent in health care and social services, and 9.0 per cent in public administration. [78] However, there is much greater variation in the industries employing life sciences, engineering and physical sciences graduates than those in education, the humanities and social sciences (who account for the large number of graduates in the educational services industry) (see table 2).

This discrepancy accounts for an important variation in salary following graduation. Although 60.4 per cent of all graduates make over $55,000 per year, this figure is attained by fully 77.9 per cent of graduates in education and other professional fields, 77.2 per cent in engineering and 72.7 per cent in the physical sciences.[79] Over half (54.7 per cent) of life sciences and social sciences graduates (55.8 per cent) earn this amount while only 34.8 per cent reach this level following degrees in the humanities.

The health of the Canadian economy as a whole is reflected in the intention of 80 per cent of Canadian doctoral students to remain in Canada.[80] Included in this number are 60 per cent of all foreign students although their prominence among graduates in the life and physical sciences helps account for the intention of one third of all students in those disciplines to leave Canada. Graduates in the life sciences graduates make up 40 per cent of all those intending to leave while those in the physical sciences account for 21 per cent of the total. The country of choice for all was the United States.

This portrait of doctoral education in Canada today – its size and distribution, supports, programs, students and graduates – reflects much of its evolution over the past hundred years. It is an evolution that has been uneven and complex, driven by changing intellectual currents and national interests negotiated through universities, provinces and the federal government. Yet, as the national importance of advanced research and research training increased after the Second World War and again in the global era, so did the scale and scope of doctoral education in Canada. There have been increasingly more programs, offering greater financial and intellectual support, opening doors to wider networks of colleagues and partners in a larger intellectual community. More students and a greater diversity of students than ever before are pursuing doctoral studies.

Table 2 – Employment by industry of doctoral graduates with firm plans for the coming year, 2005.[81]

Discipline/ Industry	Educational Services	Science, Technology	Health, Social	Public Service	Goods Producing	Other
Humanities	78.7	-	-	7.3	-	9.6
Social Sciences	51.1	6.1	29.3	9.6	-	-
Physical Sciences	43.6	26.6	-	12.5	10.1	-
Engineering	37.3	32.6	-	8.4	14.9	-
Life Sciences	38.9	19.9	15.8	10.1	8.5	6.8
Other	83.9	5.3	-	6.9	-	-
Total	57.0	13.4	10.6	9.0	4.6	5.4

In the global era, federal, provincial and institutional decisions altered the tacit post-war social contract between them and, consequently, the way doctoral studies have grown. Collectively, their decisions no longer aim to spread doctoral studies throughout the country but, rather, have encouraged or quietly accepted their concentration in provinces and cities with the necessary material, political and intellectual resources to compete in the global market for students, scholars and ideas. This competition has increased the importance of partnerships, mobility, international students and quality assessment, raising new issues for universities, provinces and the federal government alike. At the same time, however, the level and focus of government and university supports continue to influence overall participation in doctoral studies as well as the success of students in particular fields. It is these issues of purpose, regarding the scale of doctoral education and the breadth of funded studies that remain before us as we move towards a new tacit social contract for doctoral education in Canada. The way universities, provinces and the federal government answer them will determine whether tomorrow's graduates, standing at the center of convocation hall, will be able to fulfill eternal hopes for new discoveries and deeper understanding, a proud place in the international intellectual community, future generations, national prosperity and well-being.

Notes

1 Mike Lazaridis, "The Importance of Basic Research," in *Re$earch Money*, Vol. 18, no. 18, (2004), p. 8.

2 The concept of a tacit social contract, in existence since the Second World War between universities and all levels of government, is borrowed from Ben Martin, "The Changing Social Contract for Science and the Evolution of Knowledge Production" in Aldo Beuna, Ammon Salter and Edward Steinmuller, eds. *Science and Innovation: Rethinking the Rationales for Funding and Governance.* (Cheltenham: Edward Elgar, 2003). In 2001, John Evans suggested that an explicit social contract for scientific research be established between universities and the federal government given the increased role the federal government had come to play in funding advanced research. John Evans, "Higher Education in the Higher Education Economy: Towards a Public Research Contract" (Killam Annual Lecture, 2001).

3 McGill University was a notable exception to this rule. It was established as a private non-denominational institution in 1821. Much of the information in this paragraph is drawn from Glen Jones, ed. *Higher Education in Canada: Different Systems, Different Perspectives.* (New York: Garland Publishing, Inc., 1997), and early chapters in Tom Pocklington and Allan Tupper, *No Place to Learn: Why Universities Aren't Working.* (Vancouver: UBC Press, 2002).

4 Glen Jones, "Higher Education in Ontario," in Jones, *Higher Education...*, p. 139

5 Discussion of various postsecondary traditions is borrowed from Pocklington and Tupper, *No Place...* pp. 19-36.

6 A.B. McKillop, *Matters of Mind: The Ontario University, 1791-1951.* (Toronto: University of Toronto Press, 1994), p. 346.

7 In 1920, there were 24 doctoral degrees conferred in Canada; in 1930 there were 46; and in 1940 there were 75. Statistics Canada. "Degrees awarded by Canadian universities and colleges, by sex, Canada, selected years, 1831-1973." *Historical Statistics of Canada*, 11-516-X1E, Section W: Education, Series W504-512.

8 McKillop, *Matters...*, p. 344.

9 David Cameron, "Post-secondary Education and Research: Whither Canadian Federalism?" in Iacobucci and Tuohy, Taking..., p. 277.

10 University activism at this stage was important as it gave institutions and academics a measure of control over federal government initiatives. Much of the information in this and the succeeding paragraph is drawn from Cameron, "Post-secondary Education..." pp. 277-282.

11 At some point, the practice arose of allocating approximately 50-55 per cent of federal research funding directed through the granting councils to the sciences and engineering, 35-40 per cent to medical research, and 10-15 per cent to the humanities and social sciences although researchers and graduate students in these fields generally represented more than 50 per cent of their number. It is unclear how this division was first established.

12 Statistics Canada. *Historical Statistics of Canada*, 11-516-X1E, Section W: Education.

13 *Ibid.*

14 Pocklington and Tupper, *No Place....* See also Howard Clark, *Growth and Governance of Canadian Universities: An Insider's View* (Vancouver: UBC Press, 2003).

15 Statistics Canada. "Summary of total full-time enrolment, by level of study, related to relevant population, Canada, selected years, 1951 to 1975." *Historical Statistics of Canada*, 11-516-X1E, Section W: Education, Series W10-20.

16 Statistics Canada. “Degrees awarded by Canadian universities and colleges, by sex, Canada, selected years, 1831-1973.” *Historical Statistics of Canada*, 11-516-X1E, Section W: Education, Series W504-512.

17 For a different interpretation see Pocklington and Tupper, *No Place....*

18 H.H Jacobs, *1972 Statistical Report.* Ottawa: Canadian Association of Graduate Schools, 1972. p. 30.

19 L.C. Payton, *1982 Statistical Report.* Ottawa: Canadian Association of Graduate Schools, 1982. p. 26.

20 Between 1960 and 1975 the provincial distribution of the total population varied little. Approximately ten per cent of Canadians lived in the Maritime provinces, 28 per cent in Québec, 35 per cent in Ontario and 27 per cent in western Canada. In 1960, 4.1 per cent of graduate students studied in the Maritimes, 30.4 per cent in Québec, 39.9 per cent in Ontario and 25.6 per cent in the West. Fifteen years later, 6.1 per cent studied in the Maritimes, 27.7 per cent in Québec, 44.5 per cent in Ontario and 21.7 per cent in the West. Statistics Canada. “Full-time university enrolment, by sex, Canada and provinces, selected years, 1920 to 1975.” *Historical Statistics of Canada*, 11-516-X1E, Section W: Education, Series W340-438. Statistics Canada. “Population of Canada, by province, census dates, 1851 to 1975.” *Historical Statistics of Canada*, 11-516-X1E, Section A: Population and Migration, Series A2-14.

21 See articles in Glen Jones, *Higher Education....*

22 Cameron, “Post-secondary Education...” pp. 279-282.

23 Enrolment dropped in four successive years, from 1996-1999. Jean Lebel, “Table 1: Graduate Enrolment in Canada, 1990-2001” in *Statistical Report, 1990-2001* (Ottawa: Canadian Association for Graduate Studies, 2004) p. 1.

24 Paul Martin, *Budget Speech*, (Ottawa: Department of Finance Canada, 1998).

25 Wolfe, “Innovation and Research Funding...” p. 318.

26 Overcoming isolation during doctoral studies in this way has proven to reduce attrition. Barbara Lovitts, *Leaving the Ivory Tower, the Causes and Consequences of Departures from Doctoral Study* (Lanham: Rowman and Littlefield Publishers, 2001) as noted in Martha Crago, *Pre-Budget Submission to the House of Commons Standing Committee on Finance* (Ottawa: Canadian Association for Graduate Studies, 2003), p. 3.

27 Paul Martin, “Budget Speech.” (Ottawa: Department of Finance Canada, 2003).

28 Crago, “Pre-Budget...,” p. 3.

29 Statistics Canada.“Changing patterns of university financing,” *Education Quarterly Review*, Vol. 9, no. 2, (2003), pp. 11. Catalogue no. 81-003.

30 *Ibid.*

31 See articles in Jones, *Higher Education...*

32 Universities with the five largest doctoral programs enrolled 55.1per cent of all doctoral candidates in 1981 but only 47.7 per cent in 1991 and 45.7 per cent in 2001. Jacobs, 1972 Statistical Report..., p. 34-35; Payton, 1982 Statistical Report..., p. 29-32; Lebel, *Statistical Report 1990-2001...*, p. 8.

33 Manitoba. *Priorities for Advanced Education.* Winnipeg: Manitoba Education, Training and Youth, May 2001. Payton, 1982 *Statistical Report...*, p. 29-33. Lebel, *Statistical Report, 1990-2001...* p. 6-8.

34 These initiatives also led to program changes that seek to provide greater support for students. Holdaway, Edward. “Organization and Administration of Graduate Studies in Canadian Universities,” in *The Canadian Journal of Higher Education,* Vol. 24, no. 1, (1994), pp. 1-29.

35 John Evans, “Higher Education in the Higher Education Economy: Towards a Public Research Contract” (Killam Annual Lecture, 2001).

36 In Alberta, the Private Colleges Accreditation Board (established in 1984) was replaced by the Campus Alberta Quality Council in 2004. In Atlantic Canada, the provinces refocused the Maritime Provinces Higher Education Council mandate on quality assurance in 1997. Ontario established the Postsecondary Education Quality Assessment Board in 2000 and British Columbia formed the Degree Quality Assessment Board in 2003.

37 Donald Baker, "On the Need for High Quality Colleges and Programs" ACCC Annual Conference, Moncton, New Brunswick, June 3, 2005.

38 Association of Universities and Colleges of Canada. *Trends in Higher Education* (Ottawa: Association of Universities and Colleges of Canada, 2002), p. 8.

39 Payton, *1982 Statistical Report*...p. 28. Lebel, *Statistical Report 1990-2001*...p. 1.

40 Payton, *1982 Statistical Report*...p. 70. Lebel, *Statistical Report 1990-2001*...p. 36.

41 The presence of non-Canadian students in doctoral programs is higher than the national average in Atlantic Canada (38.8 per cent), Western Canada (36.9 per cent) and Québec (34.7 per cent). It is lower, at 31.1 per cent, in Ontario). Lebel, *Statistical Report, 1990-2001*... p. 36, 50.

42 Association of Universities and Colleges of Canada, *Trends*..., p. 14.

43 Statistics Canada. "Changing patterns..." p. 11.

44 *Ibid.*, p. 12.

45 At present, tuition fees for doctoral programs vary from a low of $2,502.45 per year (3 semesters), reduced to $936 per year post residency, at the Université de Montréal; to a high of $6,176 per year, with no post residency reduction, at the University of Toronto. International students pay $13,617.45 per year, reduced to $936 per year post residency, at the Université de Montréal while, at the University of Toronto, they pay $10,970 per year, with no post residency reduction.

46 Statistics Canada. "Changing patterns..." p. 13.

47 Lebel, *Statistical Report, 1990-2001*..., p. 6-8. Statistics Canada. "1996 Community Profiles: Calgary Metropolitan Area."

48 Holdaway, Edward, "Organization and Administration of Graduate Studies in Canadian Universities," in *The Canadian Journal of Higher Education*, Vol. 24, no. 1, (1994), pp. 1-29.

49 Lebel, *Statistical Report*..., p. 65. In 2003, the number of earned doctorates awarded increased to 3,900. Statistics Canada. *The Daily*. October 11, 2005. (Ottawa: Statistics Canada, 2005). Catalogue no. 11-001-XIE. p. 10.

50 *Ibid.*, p. 6-7 and Statistics Canada. *A profile of the Canadian Population: where we live. Census, 2001.* (Ottawa: Statistics Canada, 2002). Catalogue no. 96F0030XIE2001001.

51 Lebel, *Statistical Report*..., p. 6-7 and Statistics Canada. *A profile*....

52 Lebel, *Statistical Report*..., p. 8.

53 *Ibid.* and Association of Universities and Colleges of Canada, *Trends*...

54 Lebel, *Statistical Report*..., p. 9.

55 Statistics Canada, *Survey of Earned Doctorates*..., p. 10 and 27.

56 *Ibid.*, p. 28.

57 *Ibid.*, p. 11-12.

58 *Ibid.*, p. 31.

59 *Ibid.*, p. 13.

60 Conversely, there is a much greater enrolment of bachelors and masters level students in the social sciences and humanities (72 per cent) than doctoral students in those disciplines (50 per cent). The health sciences enrol 7 per cent of bachelors and masters level students and 6.2 per cent of doctoral students. Association of Universities and Colleges of Canada, *Trends...*, p. 80 and Lebel, *Statistical Report...*, p. 9.

61 Roberta-Anne Kerlin, *Towards a Theory of Women's Doctoral Persistence.* (PhD Thesis: University of Victoria, 1997) chapter 2. Statistics Canada. *Survey of Earned Doctorates...*, p. 9.

62 *Ibid.*, p. 25.

63 Edward Holdaway, "Organization and Administration of Graduate Studies in Canadian Universities," in *The Canadian Journal of Higher Education*, Vol. 24, no. 1, (1994), pp. 1-29.

64 *Ibid.*, p. 61.

65 Association of Universities and Colleges of Canada, *Trends...*, p. 5.

66 *Ibid.*, p. 4.

67 Statistics Canada. *Survey of Earned Doctorates...*, p. 9.

68 If foreign students (most of whom are male) are removed from these calculations the number of Canadian men and women enrolled in doctoral programs converges slightly more than described here. *Ibid.*, p. 14 and Statistics Canada. *Survey of Earned Doctorates: A Profile of Doctoral Degree Recipients.* Ottawa: Culture, Tourism and the Centre for Education Statistics Research Papers, 2005. Catalogue no. 81-595-MIE2005032. p. 8.

69 Lebel, *Statistical Report...*, p. 14.

70 *Ibid.*, p. 28.

71 *Ibid.*, p. 29.

72 *Ibid.*, p. 36

73 *Ibid.*, p. 42.

74 Statistics Canada, *Survey of Earned Doctorates...*, p. 9.

75 Lebel, *Statistical Report...*, p. 51.

76 Statistics Canada. *Survey of Earned Doctorates....*, p. 14.

77 *Ibid.*, p. 17 and 36.

78 *Ibid.*, p. 34.

79 *Ibid.*, p. 35.

80 Statistics Canada. S*urvey of Earned Doctorates...*, p. 18.

81 Note that "life sciences" denotes agricultural, biological and health sciences. "Other" disciplines include, principally, education and professional fields. Statistics Canada. *Survey of Earned Doctorates: A Profile of Doctoral Degree Recipients.* Ottawa: Culture, Tourism and the Centre for Education Statistics Research Papers, 2005.

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