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CANADA

Report of the
National Advisory Board
on Science and Technology

COMMITTEE ON THE PARTICIPATION OF WOMEN IN SCIENCE AND TECHNOLOGY

Presented to the
Prime Minister of Canada



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**Participation of Women
in Science and Technology
Committee Report**

February 1988

The views expressed in this paper are those of the authors and do not necessarily correspond to the views or policies of the Government of Canada.

Committee Members

Jeannine David-McNeil (Chairwoman)
Associate Professor
École des hautes études commerciales
Montreal

Patricia Baird
Professor of Medical Genetics
University of British Columbia
Vancouver

Pierre Bois
President
Medical Research Council of Canada
Ottawa

Yvon C. Dupuis
President
Consultants Dutech Inc. (and)
Canadian Council of Professional
Engineers
Longueuil

Julia Levy
Vice-President R&D Immunology
Quadra Logic
Vancouver

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1.0 PARTICIPATION OF WOMEN IN SCIENCE AND TECHNOLOGY COMMITTEE REPORT

1.1 Introduction

To make inroads in technological innovation, Canada must have at its disposal a large work force trained in the occupations associated with sciences and technologies. Since one of two workers will be a woman by the year 2000, the Canadian S&T establishment must draw on the female component in the labour force to avoid a shortage in human resources.

Women are entering the labour market in great numbers, yet the majority of them still choose to work in traditionally female occupations. Although the number of women receiving university education and diversifying their training is steadily increasing, several occupations associated with the natural and applied sciences count very few women among their ranks.

The federal government must motivate women to choose scientific and technological occupations if it wants to prevent labour shortages in the Canadian economy and to ensure that the Canadian S&T establishment has our most qualified citizens at its disposal.

1.2 The Present Situation

How many women are in S&T occupations in the labour market and in institutions of learning? Despite recent significant progress, there are relatively few Canadian women in the fields of S&T.

1.2.1 The Number of Women in Scientific and Technical Occupations

As Table 1 shows, in 1981 the proportion of women in selected technical and scientific occupational groups was 45.5 per cent; the proportion of women in all occupations was 40.4 per cent. Why, then, should we be concerned about the fact that women are underrepresented in S&T?

Essentially, the problem lies in the distribution of female workers within the various occupations. They are underrepresented in most natural science occupations, engineering, medicine and health, but are overrepresented in nursing and medical technician occupations. In the occupations considered, 77.8 per cent of the women work as specialists in nursing and therapy, whereas 48.7 per cent of the men work in the architecture and engineering groups. Thus if the specialists in therapy, nursing and the health technologies are excluded, women constitute only 10 per cent of those working in technical and scientific occupations in 1981, compared with 5.3 per cent in 1971.

The growth in the number of women in the labour market resulted in an increase in their numbers in most of the scientific and technical occupational groups. This upward trend should become more pronounced in the years to come. Nonetheless, the differences between the numbers of men and women in the work force were

so great in 1981 that it will be more than 10 years before the gap is closed. If no steps are taken to increase the representation of women in the scientific and technical occupations over the next decade, women will continue to be underrepresented in these fields, and labour shortages will affect several of tomorrow's employment sectors.

1.2.2 Professional Preferences of Female Students

Information regarding the number of women studying science at both the secondary and university levels is essential for a better understanding of the situation of women in the scientific and technological establishment.

More and more female students are choosing to prepare for scientific and technical occupations. Tables 2 and 3 indicate a substantial narrowing of the gap between the numbers of men and women in several scientific and technical fields, although certain subjects are selected exclusively by either one sex or the other.

Although young women are proportionally more numerous in all the fields of study considered as a whole, their career choices vary little. Many still choose the arts, education, applied arts medical technologies, and nursing; few take up engineering or applied sciences. In the vocational schools, girls are preparing to be secretaries, hairdressers or beauticians; none go into the building trades.

The *Annual Statistical Bulletin, 1983-1984: Canada Manpower Training Program*, published by the Department of Employment and Immigration, also confirms the tendency for women to choose traditional female occupations (See Table 4). Women opt mainly for office work; the only blue-collar occupation for which many women seek training is that of sewing machine operator.

These traditional career choices by female students can only have an adverse effect on the number of women in the scientific and technical occupations. Should an economy be oriented toward technological development, such choices can also be a cause of labour shortages in these occupations.

Girls not only avoid scientific and technological professions, but also cease taking mathematics and physics courses in the final years of secondary school. This lack of interest early in their schooling jeopardizes their participation in tomorrow's scientific careers.

1.3 Factors Contributing to the Low Level of Participation of Women in S&T

According to Canadian and foreign researchers, there are numerous reasons for the lack of interest in S&T among women. The factors most frequently are:

- a) abilities;
- b) attitudes;
- c) aspirations, social roles and role models;

- d) perception of career opportunities; and
- e) family responsibilities.

1.3.1 Abilities

The main body of Canadian and American research has found that, at the secondary and post-secondary levels, girls perform better than boys in mathematics and sciences. However, a study cited in a Science Council of Canada publication, *Who Turns the Wheel?* (1982), shows that fewer girls study physics and mathematics at advanced levels than boys. By dropping out of physics and mathematics courses in high school, girls limit their options for the future because these subjects are often prerequisites for admission to post-secondary programs. Students who opt out of science and mathematics early in their education will not be able to pursue a career in the sciences.

1.3.2 Attitudes

Many empirical studies stress that achievement in S&T depends more on the attitudes and perceptions of individuals than on their talent or performance.

According to a study by the Canadian Advisory Council on the Status of Women, *What Will Tomorrow Bring? . . . A Study on the Aspirations of Adolescent Women*, girls have less confidence in their own abilities in their educational plans because they do not believe they are capable of succeeding. Such attitudes often lead adolescent women to avoid scientific and technical fields, which they perceive as too difficult.

This lack of confidence in S&T can be explained by the fact that girls who want to prepare for scientific careers often do not get as much encouragement as they should from parents, teachers and guidance counsellors.

Moreover, teenage girls often have indifferent or negative feelings about studying sciences. Another Science Council of Canada report, *Science for Every Student - Educating Canadians for Tomorrow's World*, makes several recommendations designed to instil in female students a more positive attitude toward science education:

Science curricula for early years should take into account the preschool experiences of girls, or the lack thereof; a science-technology-society emphasis should be implemented to stress the human aspects of sciences; teaching materials, in particular science textbooks, should describe the achievements of women scientists and inventors; guidance counsellors should make female students aware of the need to plan a career and familiarize them with possible scientific and technical occupations.

1.3.3 Aspirations, Social Roles and Role Models

The difference in the career choices made by girls has been partly attributed to their educational ambitions (how far they want to go in school), career goals, or personal aspirations (family life). Some researchers have concluded that girls have limited educational ambitions, that they want to start working as soon as possible, that they are drawn to careers with an accent on human relations, and that they placed great emphasis on family life. As a result, adolescent women will not choose scientific and technical careers, which they perceive as conflicting with their ambitions.

The previously mentioned study by the Canadian Advisory Council on the Status of Women partly confirms these findings on the aspirations of adolescent women. Among them:

- a) More than 50 per cent of the female students interviewed hoped to have a professional or managerial job by the time they were 30; only a small percentage of them aspired to careers in S&T.
- b) Three-quarters of the respondents wanted to go to college or university; only 19 per cent said they could see themselves occupying jobs that were not traditionally female-dominated.
- c) Most placed importance on those aspects of a job that are traditionally considered to appeal to women: helping people, working with children, or working with the public (as opposed to with ideas or things).
- d) Of the adolescent women interviewed, 75 per cent said they wanted a career, but ranked work second in importance to family responsibilities.

Girls' aspirations and attitudes with regard to their future are attributed to the difference between the sexes in their social roles and professional role models as conveyed by society, the working world, school and the media. Television actresses (mainly those in sitcoms and soap operas) and movie stars, many of whom play characters working in traditional female occupations, were more likely to influence girls than boys.

1.3.4 Perception of Career Opportunities

Career opportunities for women in the labour market can influence the educational path chosen by female students. A lack of awareness of the available jobs and misconceptions about working conditions of professionals in S&T can lead girls to avoid these fields.

Limited opportunities of advancement and success, as well as the isolation of women practicing male-dominated professions, can also steer female students away from such jobs.

1.3.5 Family Responsibilities

The preferred lifestyle cited by most adolescent women is marriage and family life. Most are convinced that the wife must do most of the housework, whether she works or not.

Girls who see a possible conflict between family responsibilities and the efforts required to succeed in a scientific career might be discouraged from aiming for such a career.

Thus, the factors contributing to the low level of participation of women in S&T appear sufficient to warrant directing government measures at improving female representation in these fields.

1.4 Recommendations

For reasons of *equality* and efficiency, the government must ensure that women play a significant role in the scientific and technological establishment, and that all the abilities available to society are used. Equality in the work place and current social and technological changes necessitate the removal of the barriers restricting women's career and educational choices in S&T. Certain measures will be required to overcome these obstacles.

1.4.1 Providing Information and Raising Awareness Levels among Girls and the Members of the Sectors Involved

Government agencies and departments must establish a large-scale information and public awareness program from preschool through to the post-secondary level to motivate girls to choose scientific and technical training. This program could include:

- a) a campaign to make female high school students aware of the importance of mathematics and sciences in choosing a career path for the future;
- b) information on the number of jobs and working conditions in S&T;
- c) a campaign aimed at all those who influence the educational growth of girls (parents, teachers, guidance counsellors) to make them aware of the role-model attitudes, values and behaviour most likely to motivate girls to select and persevere with scientific and technical careers;
- d) encouraging the media to publicize female scientists and technicians, their achievements and discoveries;
- e) financial assistance to agencies that organize activities specifically designed to make sciences more appealing to girls; and
- f) scholarships to underscore scientific or technical achievements by girls.

1.4.2 Providing Incentives for Guiding Female Students into the Scientific and Technological Fields

The funding agencies and departments concerned with S&T must provide measures to encourage more women to study in the scientific and technological fields. These could include:

- a) scholarship programs;
- b) review and adoption of policies, provisions, and standards that take into account the responsibilities and constraints associated with motherhood (standards containing time-related criteria or age limits must be adjusted to allow for longer maternity leave); and
- c) review of the methods used to select trainees for Canada Employment Immigration Centre (CEIC) training and apprenticeship programs, to eliminate all discriminatory practices.

1.4.3 Developing Science Programs Designed to Create and Sustain Interest among Female Students in Scientific and Technological Subjects

To encourage more women to take different S&T disciplines, it is necessary to:

- a) review and redefine the content of courses, activities, and textbooks related to S&T teaching to integrate the cultural experience of women and to accord more importance to contributions made by female scientists;
- b) encourage an increase in the number of women teaching scientific and technological subjects; and
- c) fund experimental projects to develop ways to stimulate interest in S&T among teenage girls (teaching aids and methods designed for this purpose, mathematics and science courses given to exclusively female groups, etc.).

1.4.4 Facilitating Access to Scientific and Technical Occupations for Women

Constraints preventing women from enjoying careers in S&T must be eliminated by:

- a) making society aware of the need for a greater sharing of family responsibilities between spouses;
- b) establishing a daycare network;
- c) providing work schedules compatible with the family responsibilities of workers of both sexes in S&T occupations; for example, flexible hours, compressed work week, part-time, or parental leave; and
- d) applying equal opportunity programs not only in firms dealing in S&T with

which the government has major contracts, but also in government laboratories, Crown corporations, departments and funding bodies.

1.5 Conclusion

Several of the proposed recommendations should be announced at the January 1988 conference. At that time, we should plan a number of activities to promote the participation of women in S&T.

Table 1

Labour Force 15 Years and Over and Percentage of Women in Each Professional, Scientific and Technical Group Retained, Canada, 1971 and 1981

No. OCCUPATIONAL GROUP ¹	1971			1981		
	Women	Total	% of Women	Women	Total	% of Women
Management and Administration						
1131 Management occupations, natural sciences and engineering	65	2 515	2.6	770	12 005	6.4
Natural Sciences	8 695	53 415	16.2	15 090	68 835	21.9
2111 Chemists	800	7 140	11.2	1 865	9 380	19.9
2112 Geologists	140	4 690	3.0	735	7 395	9.9
2113 Physicists	40	785	5.1	65	1 275	5.1
2114 Meteorologists	35	800	4.4	65	930	6.9
2117 Physical sciences technol. and technicians	2 715	17 850	15.2	4 685	19 930	23.5
2119 Occupations in physical sciences, n.e.c.	300	3 040	9.9	140	1 590	8.8
2131 Agriculturists and related scientists	260	5 985	4.3	1 065	8 760	12.1
2133 Biologists and related scientists	715	2 970	24.1	2 185	7 015	31.1
2135 Life sciences technologists and technicians	3 075	8 520	36.1	3 735	10 585	35.3
2139 Occupations in life sciences, n.e.c.	615	1 635	37.6	550	1 975	27.8
Architecture and Engineering	4 385	154 465	2.8	28 995	266 380	8.3
2141 Architects	115	4 040	28.4	520	7 110	7.3
2142 Chemical engineers	50	3 460	1.4	325	5 535	5.9
2143 Civil engineers	215	21 445	1.0	900	32 010	2.8
2144 Electrical engineers	180	14 995	1.2	965	26 720	3.6
2145 Industrial engineers	485	14 680	3.3	3 205	26 315	12.2
2147 Mechanical engineers	85	12 840	0.7	375	18 995	1.9
2151 Metallurgical engineers	15	855	1.7	45	1 730	2.6
2153 Mining engineers	20	2 040	1.0	95	3 415	2.8
2154 Petroleum engineers	15	1 380	1.1	210	4 395	4.8
2155 Aeronautical engineers	20	1 550	1.3	55	2 505	2.2
2157 Nuclear engineers	-	260	0.0	45	835	5.4

<u>No. OCCUPATIONAL GROUP¹</u>	1971			1981		
	<u>Women</u>	<u>Total</u>	<u>% of Women</u>	<u>Women</u>	<u>Total</u>	<u>% of Women</u>
<u>Architecture and Engineering</u> (cont'd)						
2159 Architects and engineers, n.e.c.	135	3 380	4.0	1 520	12 860	11.8
2160 Supervisors: other occupations in arch. and engineering	25	2 935	0.8	375	8 515	4.4
2161 Surveyors	165	10 270	1.6	785	17 880	5.5
2163 Draughtsmen	2 045	27 380	7.5	7 840	43 020	18.2
2165 Architectural and engineering technologists and technicians, n.e.c.	565	24 015	2.3	4 005	49 060	8.2
2169 Other occupations in architecture and engineering, n.e.c.	250	8 940	2.8	660	5 480	12.0
<u>Mathematics and Computer Science</u>						
2181 Mathematicians statisticians, and actuaries	775	3 660	21.2	1 765	5 605	31.5
2183 Systems analysts, computer programers and related occupations	3 235	22 475	14.4	17 410	61 065	28.5
2189 Occupations in mathematics, statistics, systems analysis and related fields, n.e.c.	15	105	14.3	495	1 065	46.5
<u>University Teachers</u>						
2711 University teachers	3 915	23 450	16.7	8 245	33 615	24.5
2719 University teaching and related occupations, n.e.c.	800	3 030	26.4	4 885	11 075	44.1
<u>Medicine and Health</u>						
3111 Physicians and surgeons	2 890	28 585	10.1	6 925	40 545	17.1
3113 Dentists	305	6 430	4.7	805	10 290	7.8
3115 Veterinarians	70	1 715	4.1	550	3 375	16.3
3117 Osteopaths and chiropractors	80	1 075	7.4	300	2 195	13.7

No. OCCUPATIONAL GROUP ¹	1971			1981		
	Women	Total	% of Women	Women	Total	% of Women
<u>Other Occupations in Medicine and Health</u>	<u>4 190</u>	<u>14 115</u>	<u>29.7</u>	<u>10 415</u>	<u>22 350</u>	<u>46.6</u>
3151 Pharmacists	2 170	9 410	23.1	5 695	13 800	41.3
3152 Dietitians and nutritionists	1 700	1 790	94.9	3 080	3 275	94.0
3153 Optometrists	95	1 525	6.2	355	2 000	17.7
3154 Dispensing opticians	225	1 390	16.2	1 285	3 275	39.2
<u>Nursing and Therapy</u>	<u>182 375</u>	<u>203 705</u>	<u>89.5</u>	<u>316 275</u>	<u>354 745</u>	<u>89.1</u>
3119 Health diagnosing and treating occupations, n.e.c.	755	1 315	57.4	1 990	3 535	56.3
3130 Supervisors: nursing occupations	3 500	14 550	92.8	19 410	21 270	91.2
3131 Nurses, graduates and in training	100 280	104 630	95.8	167 710	175 825	95.4
3134 Nursing assistants (authorized)	25 065	27 285	91.8	41 090	44 900	91.5
3137 Physiotherapists, occupational and other therapists	5 100	6 250	81.6	11 575	13 680	84.6
3139 Nursing, therapy and related assisting occupations, n.e.c.	7 780	9 480	82.1	10 135	14 175	71.5
3155 Radiological technologists and technicians	4 730	6 445	73.4	7 415	9 330	79.5
3156 Medical laboratory technologists and technicians	13 575	17 980	75.5	26 065	33 490	77.8
3157 Dental hygienists, assistants and technicians	8 185	10 695	76.5	19 235	23 715	81.1
3159 Other occupations in medicine and health, n.e.c.	3 405	5 075	67.1	11 650	14 825	78.6
<u>Scientific and Technical Occupations</u>	<u>211 795</u>	<u>549 885</u>	<u>38.5</u>	<u>406 055</u>	<u>893 140</u>	<u>45.5</u>
<u>All Occupations</u>	<u>2 961 210</u>	<u>8 626 925</u>	<u>34.3</u>	<u>4 853 115</u>	<u>12 005 320</u>	<u>40.4</u>

n.e.c - Not elsewhere classified

¹Classification of Occupational Groups

Source: Statistics Canada, 1981 Census of Canada, "Labour Force: - Occupation Trends." Catalogue 92-920, November 1983, Table 1.

Table 2

University Enrolment by Field of Study and Sex, Canada 1970-71 and 1980-81

Field of study	1970-1971			1980-1981		
	Women	Total	% of Women	Women	Total	% of Women
<u>Humanities</u>	<u>74 061</u>	<u>173 752</u>	<u>42.6</u>	<u>104 765</u>	<u>200 473</u>	<u>52.3</u>
Arts	45 883	103 108	44.5	51 141	94 706	54.0
Business, commerce	1 708	16 747	10.2	16 564	44 527	37.2
Education	21 731	38 531	56.4	24 958	36 382	68.6
Fine arts and applied arts	3 093	5 446	56.8	7 508	12 189	61.6
Law	913	7 250	12.7	3 722	9 743	38.2
Religion/theology	733	2 670	23.7	872	2 926	29.8
<u>Sciences</u>	<u>23 295</u>	<u>100 925</u>	<u>23.1</u>	<u>47 172</u>	<u>130 957</u>	<u>36.0</u>
Sciences	14 421	51 507	28.5	23 436	58 153	40.3
Agriculture	391	3 721	10.5	1 681	4 736	35.5
Environmental studies	-	-	-	700	1 994	35.1
Engineering and applied sciences	51	25 706	0.2	3 710	38 247	9.7
Dentistry	92	1 651	5.6	413	1 994	20.7
Medicine	1 038	5 733	18.1	3 521	9 780	36.0
Various health-related occupations	1 905	2 500	76.2	2 541	3 080	82.5
Nursing	4 298	4 391	97.9	5 676	5 846	97.1
Pharmacy	1 013	2 068	49.0	1 755	2 755	63.7
Veterinary medicine	86	707	12.2	472	1 007	46.9
Home economics	2 920	2 941	99.3	3 267	3 365	97.1
Grand Total	101 401	276 297	36.7	156 274	339 726	46.0

Table 3

Full-Time Enrolment in Community Colleges by Field of Study and Sex,
Canada, 1970-1971 and 1983-1984

Field of Study	1970-71			1983-84		
	Women	Total	% of Women	Women	Total	% of Women
Arts	5 053	9 590	52.7	10 549	19 026	55.4
Business and commerce						
Secretarial science	-	-	-	13 679	13 750	99.4
Management and administration	-	-	-	21 398	40 256	53.1
Computer science	-	-	-	7 768	17 234	45.1
Financial management	-	-	-	3 643	6 581	55.4
Other	-	-	-	3 555	7 005	50.7
Total	8 236	27 004	30.5	50 043	84 825	59.0
Community services	32	57	56.1	18 879	26 927	70.1
Education	7 919	10 848	73.0	n/d	n/d	n/d
Architecture	56	1 187	4.7	961	5 814	16.5
Engineering - mechanical	-	94	-	148	6 139	2.4
Engineering - general	42	3 206	1.3	742	8 158	9.1
Techniques	-	-	-	1 248	2 966	42.1
Electronics	-	7 852	0.01	729	18 696	3.9
Others	-	-	-	202	3 283	6.1
Health-related sciences						
Nursing	26 094	26 545	98.3	21 346	23 306	91.5
Health-related technologies	-	-	-	5 589	7 633	73.2
Other	3 088	3 608	85.6	1 319	1 670	78.9
Total			n/d	119 803	205 575	58.3

Source: For 1970-71, Statistics Canada, *Education in Canada 1961-1971*, catalogue 81-229, table 39, p. 155; for 1983-1984, Statistics Canada, *Community Colleges 1983-1984*, catalogue 81-222, calculated on the basis of table 7, p. 91.

	Institutional Training Program*		Industrial Training Program **		Occupations Training Program	
	Men	Women	Men	Women	Men	Women
Total number of trainees	18 413	42 695	8 173	25 427	557	11 962
Percentage distribution of trainees by sex	30.1	69.9	24.3	75.7	4.4	95.6

n.e.c. - Not elsewhere classified

* Full-time trainees only

** Excluding the Critical Occupations Training Program

*** Numbers in parentheses correspond to two-digit CCDO occupational designations

Source: Employment and Immigration Canada. *Annual Statistical Bulletin, 1983-1984: Canada Manpower Training Program*. Ottawa, 1984. pp. 72, 97 and 125.