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Research Directorate-General

Science policies in the European Union:

Promoting excellence through mainstreaming gender equality

A Report from the ETAN Expert Working Group
on Women and Science

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Research Directorate-General

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Science policies in the European Union: Promoting excellence through mainstreaming gender equality

A report prepared for the European Commission by the independent ETAN Expert Working Group on women and science

European Technology Assessment Network (ETAN) on Women and Science

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Executive summary

- 1 The General Directorate of Research commissioned this report on gender aspects of research policy in the EU. It was prompted by concerns expressed in the Commission, the European Parliament, the Council and the Member States. It has been prepared by a European Technology Assessment Network (ETAN), chaired by Mary Osborn. Its authors are senior scientists from different disciplines from ten Member States, from universities, research institutes, business and politics. The report reviews the position of women in science and technology. It concludes that the under-representation of women threatens the goals of science in achieving excellence, as well as being wasteful and unjust. The report makes recommendations to a wide range of bodies, including the Commission, the European Parliament, the Member States and organisations that educate, fund and employ scientists.
- 2 Following the UN Beijing Conference on women in 1995, the importance of ‘mainstreaming’, or integrating gender equality, has been highlighted in the EU. The report discusses how a mainstreaming policy could be implemented in science.
- 3 A statistical review of the position of women in higher education, research institutes, in industry and among members of senior scientific committees is presented at both the EU and the Member State level. Women form 7% or less of full professors in 6 Member States. Despite country variations in systems and structures, the proportion of women in senior scientific positions is consistently extremely small. In many Member States less than 5% of the members of learned academies are female.
- 4 Women constitute half the undergraduate population. However, there is a continuous drop in the numbers of women at each level of the academic ladder and many highly trained women are lost to science. Institutions that employ scientists tend to be behind the times in addressing the life/work balance and need to modernise.
- 5 Old-fashioned practices characterise employment and promotion procedures in some of our academic institutions. Reliance on patronage, the ‘old boys network’ and personal invitations to fill posts cuts across fair and effective employment procedures. More sophisticated means of assessing merit are recommended.
- 6 The peer review system is revered for its objectivity and fairness but does not always work as it should. Both sexism and nepotism have been documented as interfering with the peer review process.

Recommendations are made for modernising peer review and ensuring fairness in research funding.

- 7 The narrowness of the characteristics of the scientific elite is highlighted, especially in decision-making bodies. The case is made on democratic grounds for women to have more say in shaping the scientific agenda. We propose a minimum of 30% of both genders on such committees by 2002 and 40% by 2005. In addition improvements in the quality of science could be brought about through more gender-aware research.
- 8 Attracting more young people into science poses challenges for education. The sex-stereotyping of science and scientists needs to be tackled through the curriculum, through pedagogy and through the media. Various strategies to encourage women to enter and remain in science are commended. These include role models, mentoring, networks, schemes for parents returning after career breaks, and encouragement to women to apply for fellowships and posts.
- 9 Assessing the position of women is made difficult by the absence of reliable, accessible, harmonised data broken down by gender, and where appropriate, also by level. Gender monitoring is a key element of gender mainstreaming and few organisations were found to maintain adequate gender monitoring statistics. Recommendations in this area include a Directive on gender monitoring by employers; new Member State laws on gender balance on public bodies and on access to public records in those countries where such laws do not exist, and the improvement and harmonisation of the gender dimension of databases held by the EU, Eurostat and Member States. Work also needs to be done on incorporating other equality dimensions featured in the Amsterdam Treaty, as appropriate.
- 10 A key recommendation in the report is to mainstream gender equality into the Sixth Framework Programme and into Member State programmes that fund science and technology. We make a set of proposals for specific activities within the Sixth Framework Programme. These include support for both female and male scientists in independent positions (Eurogroups), 'one time grants' to provide innovative funding for women, resources for networks designed to increase communication between scientists, as well as other novel initiatives to benefit women in science.
- 11 Specific recommendations are also addressed to Member States and institutions within them. Measures are suggested to develop best practice policies in the recruitment and employment of scientists, to evaluate and achieve gender parity in academia and to ensure high quality standards in peer review and selection procedures. Active measures should be taken to eliminate the gender pay gap. In addition, importance of monitoring and review, and of using financial incentives to ensure progress on the equality agenda are stressed.
- 12 Finally, there is a need to build a consensus for further action to advance the agenda for women in science at the European level. This should involve the Commission, the European Parliament, and the Council, as well as politicians and organisations in the Member States. Women scientists themselves have an active role to play.

Foreword

As we enter the 21st Century, the role played by science and technology will become more important than ever before. To allow us to meet the challenges and opportunities, which will present themselves in the new millennium, it is essential that Europe maximises its total research potential. However, there is one key issue, which is continuing to limit Europe's future research potential: the under-representation of women in fields of science, research and development.

As Commissioner for Research, the lack of women scientists within European research is one of my particular concerns. It is important that this issue is given high priority in the debate on future science policy, and that steps are taken to try to re-address the imbalance between male and female researchers. The stronger presence of women in research would improve the utilisation of human resources while enriching the scientific enterprise by bringing in new themes and perspectives.

In this context, I am very pleased to present the European Technology Assessment Network report on Women and Science: 'Mainstreaming gender equality through the European Union's science policies'. This report addresses the aspects of under-representation of women researchers with great insight and paves the way for possible action to be taken at a number of different levels: regional, national, and European. Efforts made in this direction would be a strong component of the creation of a genuine European Research Area which I consider indispensable.

I warmly welcome this report and am confident that this will make a significant contribution in the debate.

*PHILIPPE BUSQUIN,
Commissioner for Research*

Preface

In 1998 the European Commission's Research Directorate-General (formerly known as DGXII) set up an expert group on women in science and charged the members with the task of preparing a report on women in science policy in the European Union. Growing concern had been expressed at the lack of women not only among career scientists but also among those who shape scientific policy. The term science here is used broadly and includes the social sciences, engineering, technology and computing. This report is the outcome of the group's work. It is intended to feed in to the growing debate on the subject at institution, Member State and EU level as well as further afield.

The report is aimed at all those whose work has a bearing on educating scientists, creating images of science and scientists, reviewing the work of scientists, recruiting and promoting scientists, funding science, exploiting the results of science and shaping the scientific agenda. Gender discrimination, whether direct or indirect, should have no place in the structuring or shaping of science, nor should it influence the ways in which the scientific community develops.

The recommendations target three groups: the EU and its institutions, the Member States and the institutions in them that employ scientists, and scientists themselves, men as well as women. Both the current Commissioner of the Research Directorate-General, Philippe Busquin, as well as the former Commissioner, Edith Cresson, have expressed a strong commitment to gender equality. The Commission and the European Parliament that came into office in 1999 have also stressed the necessity of including more women at all levels in science and in decision making. It is therefore a particularly opportune time to push forward the agenda on women and science both at the European and at Member State level. In the interests of social justice and the need to foster excellence in scientific endeavour in the European Union, we invite stakeholders to respond to our recommendations not only with words, but also by taking appropriate actions to correct the gender imbalance in science.

I Introduction

Science has been defined as a means to satisfy curiosity, to produce solutions to everyday problems, to improve quality of life, to understand how things work and to stimulate the economy. The wealth and quality of life of the citizens of the European Union (EU) are dependent, to a significant extent, upon the successful development of excellence in science. Europe has a fine tradition of discovery and invention in its universities, its research institutions, academies and companies: there has also been an abundance of creativity in the application of science to the generation and sustenance of enterprises that, in turn, create jobs and generate income. However, this picture is marred by the fact that a person's gender plays a disproportionate role in the likelihood of their being able to enter, remain in and succeed within the scientific community. While the presence of women in science has been increasing, extraordinarily few have an equal opportunity to make a contribution and enjoy the benefits of a scientific career. This is both unjust and inefficient. This report shows both historically and currently, women play a very minor role in decision-making about scientific policies and priorities and relatively few pursue scientific careers. This is notwithstanding the facts that they constitute over half the population of the EU, they make a substantial contribution to the taxes that pay for the development of science and technology and they are on the receiving end of outcomes derived from science policy. Women should have an equal right to enjoy the advantages that a scientific career can offer and to be involved in decision making on research priorities. Indeed, their contribution is vital to the future development of science in Europe: in order to develop science and its applications to the highest standards, we need the best human resources at our disposal, both those of women and men.

How can the role of women be enhanced in science, engineering and technology policy and practice in the EU?

This report seeks to answer that question. More specifically, it presents data that demonstrate that gender is still in some instances playing an unwarranted and outdated role in the allocation of positions and resources in science and technology. It argues that the policies and practices that operate in our scientific institutions discriminate against women (albeit at times inadvertently) and by so doing, allow a person's gender to be more

73% of all industrial patents were based on findings generated within basic research that was funded by government agencies or other non-profit organisations.

Narin, Hamilton and Olivastro (1997) *Research Policy*, no 26, pp 317-30.

62% of scientific articles that constituted key articles for the advancement/cure of cardiovascular and pulmonary diseases were derived from basic research.

Comroe and Dripps (1976) *Science*, no 192, pp 105-11.

'No matter what the level of natural resources present within a country, ultimately its development depends on knowledge, skills and capacity of all its people.'

Shirley Malcolm of the American Association for the Advancement of Science, addressing the ICSU/ UNESCO World Conference on Science, Budapest 1999 Cited in Loder, N. (1999).

significant than their excellence. Even the highly respected peer review system, which is the cornerstone of scientific evaluation, is found not always to work in the way that it should (see Chapter 4). Discrimination, direct or indirect, has no place in science. It is vital that these institutionalised forms of exclusion are identified and ameliorated for the sake of good science and technology and in the name of social justice. This report seeks to help in this endeavour by identifying in particular some of the more subtle barriers to women's participation and suggesting solutions to policy makers at all levels. Recommendations are made to a range of bodies at EU, Member State and institutional level to address these issues.

The European Commission's mainstreaming policy

What is mainstreaming?

'Mainstreaming is the systematic integration of equal opportunities for women and men into the organisation and its culture and into all programmes, policies and practices; into ways of seeing and doing.'

Rees, T. (1998) *Mainstreaming Equality in the European Union* London: Routledge.

In recognition of the importance of using human resources wisely and fostering equal opportunities, the Commission has introduced a policy of 'mainstreaming' or integrating gender equality into all institutions, policies, programmes and practices. This is a long term strategic approach to gender equality designed to complement the legal right women have to equal treatment with men, and positive action measures, designed to address some of the disadvantages they face. There are, then, three broad approaches to promoting gender equality (Rees, 1998):

- equal treatment _____ ensuring men and women are treated the same;
- positive action _____ special actions to redress disadvantage; and
- mainstreaming equality _____ integrating gender equality into systems, structures, institutions, programmes, policies and practices.

This new policy is enshrined in the Treaty of Amsterdam and spelled out in the Commission's *Mainstreaming Communication* (CEC, 1996). The growing attention being paid to gender equality is reflected in the fact that equal opportunities is one of the four pillars of the Member States' *Employment Action Plans*, designed to enhance the economic competitiveness of the EU and combat social exclusion.

Mainstreaming equality in science policy

Concerns about the under-representation of women in science and technology research in general, and in decision-making in particular, was expressed by the Commission as long ago as 1988. For instance, the European Parliament's *Resolution on Women and Research* (16.9.88) stated that 'the under-representation of women in academic life is a highly topical problem and calls for practical incentives'. It calls upon Member States to 'promote positive measures to further the presence of women at the highest levels in universities and research institutes.' At an international workshop on the topic held in 1993 (Logue, 1993), concerns were expressed about the lack of women in science posing threats to:

- equity _____ gender discrimination is a violation of human rights;
- excellence _____ the under-representation of women threatens excellence;

- efficacy _____ the ageing population makes it essential to target both genders in the shrinking pool of young scientists; and
- efficiency _____ it is wasteful to educate and train young women scientists but then not to use their skills in employment.

These concerns were discussed at a second event, a major conference on Women in Science held in April 1998 (EC, 1999). They are addressed to an extent in the approach to mainstreaming gender equality in the EU's science policy, set out in the Commission Communication: *Women and Science: Mobilising Women to Enrich European Research* (EC, 1999). This states that the evaluation of the Fifth Framework Programme will include science by women, for women and about women. It calls for active discussion and sharing of experience on the issue of women in science and the development of better indicators for measuring inequality. A Gender and Science Watch System (Genderwatch) has been set up within the Commission to monitor and implement the integration of the gender dimension in the Fifth Framework Programme. It will collect and disseminate statistics, encourage women's participation in evaluation panels and consultative assemblies, conduct gender impact studies of the research programmes, and provide a contact point within the Commission.

Attention has been drawn to the issue of the under-representation of women in designing research programmes. The question has to be asked: would more women in the Council of Ministers, among the top A grades in the Research Directorate-General and among panel members, applicants and evaluators have resulted in a different pattern of spending? Attention has been drawn to this issue by representatives of the European organisation WISE (Women's International Studies Europe 1998). There has been a significant increase in the proportion of women on Framework monitoring and evaluation committees, albeit from a very low base. The European Parliament has played an active role in ensuring that the gender dimension is taken into account in the Fifth Framework Programme.

In response to the Commission's Communication on *Women and Science*, the Council of the EU passed a Resolution inviting Member States (Council of the European Union, 1999:4):

- to review established mechanisms for collecting gender disaggregated statistics;
- to engage in the dialogue proposed by the Commission about policies implemented in Member States; and
- to pursue the objective of gender equality in science by appropriate means.

It is important that universities, research councils, centres and institutes, companies employing scientists as well as the Member States and the Commission itself, think through the implications of this enhanced focus on gender equality. This report is designed to help the scientific and technology communities including decisionmakers of the EU to fulfil the commitment to gender mainstreaming.

Mme Edith Cresson: former Research Commissioner

'C'est le moment de renouveler la pensée, et je pense sincèrement que les femmes ont là un rôle moteur à jouer. Je n'ai pas été une féministe de la première heure, comme souvent mes amies en France me l'ont reproché. J'ai cru pendant longtemps que le problème était derrière nous, qu'il était plus ou moins réglé, que c'était un problème des générations précédentes, et puis je me suis aperçue que ce n'était pas vrai du tout.'

Statement made at the 1998 EU Conference on Women and Science (EC, 1999)

'Since 1995, WISE representatives have been actively approaching both national and EU political bodies with the urgent message that gender issues and women's studies should be included in all present and future EU science, research and development policies.'

(CEC, 1999, p 109)

A growing concern with gender equality in science

In the US women in academia began to make progress in the 1970s. This was dependent on three factors: concerted protest by women themselves, appropriate legislation and the use of class action suits to enforce the legislation (Chamberlain, 1988). Affirmative action procedures have also been very important in the U.S in the last two decades. Canada and Australia have also devoted considerable attention to the issue.

In Europe the position of women in science has been an extraordinary story (see Chapter 3). They were in effect legally excluded from many areas of science in some European countries, for example the UK, in the early part of this century. The issue of women and science was taken up first in the Nordic countries in the 1980s. In Germany the first national report on the Promotion of Women in Science was published in 1989 (see section 2.4, Appendix 1).

In the 1990s gender equality and science is attracting increasing attention within Member States. Important documents designed to shape government policy have been produced in recent years, for example, in:

- United Kingdom _____ *The Rising Tide (1994)*
- Denmark _____ *Excellence in Research (1995)*
- Finland _____ *Women in Academia (1998)*
- Germany _____ *Recommendations for Equal Opportunities for Women in Science (1998)*

These and other key reports (see Key Sources for a list and Appendix I for a summary of their main findings and recommendations), designed to influence national policy, contain considered and radical proposals for improving the position of women in science and thereby enhancing the quality of science. Some excellent initiatives have been developed in some Member States, based on sound analyses (see CEC, 1999: Annex 1 for an overview). However, a concerted effort is needed if progress is to be more than a collection of piecemeal projects. This report identifies and documents some of the more effective policies and initiatives in order to allow good practice to be emulated by others.

As an indication of the growing concern with this issue, two major European Commission conferences have been held on women and science, in 1993 (Logue and Talapessy, 1993) and 1998 (EC, 1999), bringing together scientists and those concerned with funding and administering science and science policy. Many of the observations and recommendations emanating from these events are echoed in this report. Moreover, a meeting of women in science networks throughout Europe met in Brussels in July 1999 ('networking the networks') and delegates agreed on the text of a Declaration calling for urgent attention to be paid to the issue of gender equality in science (see Appendix II for the full text).

The Council of Europe recently discussed a report on the role of women in science and technology and identified three goals (Council of Europe, 1999):

- to improve our information on the place women occupy in science and technology;

In Finland a governmental committee made a very thorough report and issued recommendations on the topic in 1982. (Naisten tutkijanuran ongelmat ja esteet.

Opetusministeriön asettaman työryhmän mietintö.

Komiteamietintö 1982:33). A follow-up report was made in 1986.

In Sweden, the government decided in 1982 that gender equality should be given high priority in all research. It ordered a report from the National Council for Equality on the low proportion of women in research. This report, "Om hälften vore kvinnor..." (If half were women...) came out in 1983. It included an analysis of the situation as well as recommendations for action.

Both the Finnish and the Swedish reports were commissioned by the national governments, and published in high prestige official publications series. Female scientists of high standing participated in drafting both reports. In the early 1980s these kinds of documents were not translated into English very often, and there was rather limited interest in the topic elsewhere in Europe

"Om hälften vore kvinnor.... Kvinnor i forskningen". Jämställdhetskommittens betänkande om kvinnorna i forskningen. Sveriges Offentliga Utredningar 1983:4.

Fogelberg et al, 1999, Stahle B

- to improve girls' access to scientific and technological studies and careers; and
- to achieve greater equality in the relations between men and women throughout society.

Similarly, the International Council on Science and the United Nations Educational, Scientific and Cultural Organisation (UNESCO) debated the subject at their *World Conference on Science* held in Budapest in June 1999 (UNESCO, 1999). Again, we draw upon their deliberations in this report. Some common themes emerge from these Member State, EU and wider reports, discussions and debates. The EU must draw upon all this work and not get left behind in the endeavour to open science up to women.

Promoting excellence through mainstreaming gender equality

The Commission has requested this report in the context of its concern to mainstream gender equality in science policy. Its authors are senior scientists from different disciplines from ten Member States, from universities, research institutes, business and politics, many of whom have been active in promoting the issue of women in science policy (see Notes on Contributors). The purpose of the report is to encourage and inform debate on women in science with a view to acting as a catalyst to change. The social justice and business case arguments for mainstreaming equality in science and technology are pressing. The status quo is wasteful and inequitable. The abuse of the 'old boys' network' in some of our scientific institutions is an anachronism. The emphasis on gender in hiring and promoting has no place in modern institutions. It is not only bad for science but it denies many women the benefits of a scientific career that are enjoyed by men, such as the satisfaction of curiosity, setting one's own priorities, some status, and a certain degree of autonomy. This undoubtedly provocative report does not argue for special pleading for women. Rather, it points out the unjustifiable advantages that men currently receive through the organisation of science. It makes the case for genuine equal treatment for men and women, for an authentically gender-neutral science. While gender is an important and legitimate variable to control in some research, for example in medical science, it is not appropriate for the organisation of scientific professions themselves, nor for the allocation of resources and rewards within them.

... Women share ... the belief that there is no evidence that sex is related to success in scientific research and are prepared to be judged by the same objective standards as their male colleagues. However in return women have the right to demand the same job opportunities and the same resources, and to enjoy the same privileges as are given to men at similar stages in their careers.

from a letter to *Nature* by Mary Osborn, 360,101 (1992)

The main questions addressed by the report are as follows:

- What is the position of women in science?
- How can institutions that employ and promote scientists open up more to women?
- How can fairness be assured in funding and assessing research?
- How can women have a more active role in shaping science and scientific policy?
- How can schools and the media encourage more girls to enter science?
- How can stereotypes be challenged?
- How can gender equality be mainstreamed into scientific institutions?
- How can gender disaggregated statistics and equality indicators be developed?
- How can change be made to happen?

The report concludes with a series of recommendations for institutions of all levels. The overall aim is to ensure that the best human resources available for science and technology in the EU are given the opportunity to shape policy, take up careers, receive investment in their ideas and have their work rewarded appropriately.

'Each generation of young women including those who are currently senior faculty, began by believing that gender discrimination was 'solved' in the previous generation and would not touch them.

Gradually, however, their eyes were opened to the realization that the playing field is not level after all, and that they had paid a high price both personally and professionally as a result'.

Mary-Lou Pardue and colleagues (MIT) (1999), cited in *Nature*, no 401, p 99.

The scope and purpose of the Report

The main focus of the report is on science and science policy, within which we include engineering, the social sciences, computing and technology. We have not considered the arts and humanities but work is needed here too. We are concerned with organisations that:

- determine science policy (such as the European Commission and its committees, national and regional governments, research councils, funding bodies, large corporations);
- employ and organise scientists (universities, research institutes, professional associations, trade unions, employers in the private sector, especially medical fields and companies in certain sectors (high tech small and medium size enterprises, multi-national pharmaceutical companies, computing industry and agro-businesses);
- educate and train scientists (schools, further and higher education, museums and exhibitions, the media);

Our focus is on influencing policy at all levels to improve the position of women in science and in the development of science policy in the EU in the short, medium and long term. Integrating equality into the range of institutions, which teach, train, recruit and fund science would make a considerable difference. Our key themes are fairness in career structures, in peer review and funding excellence and in academic leadership and the setting of scientific policy and priorities.

While change will cost money, so does doing nothing. While waiting for equality to happen of its own accord may be rewarded with some progress in some areas, it can also lead to backward steps. Scientific thinking needs to be applied to the issue of women in science.

2 Women in science today

This chapter reviews the position of women in science in the EU, drawing upon such scant, haphazard and hidden data as exist, and setting the context for the chapters that follow. It demonstrates that after overcoming serious barriers aided by the law and special schemes, women are beginning to make progress in science, engineering and technology but at a very slow pace. They have not entered all disciplines to the same extent and where they are found, they remain at or near the bottom rungs of the ladder in those disciplines. Moreover, in some fields, the position of women is worsening. The figures provide a shocking snapshot of exclusion and segregation.

The lack of statistics and gender equality indicators creates problems

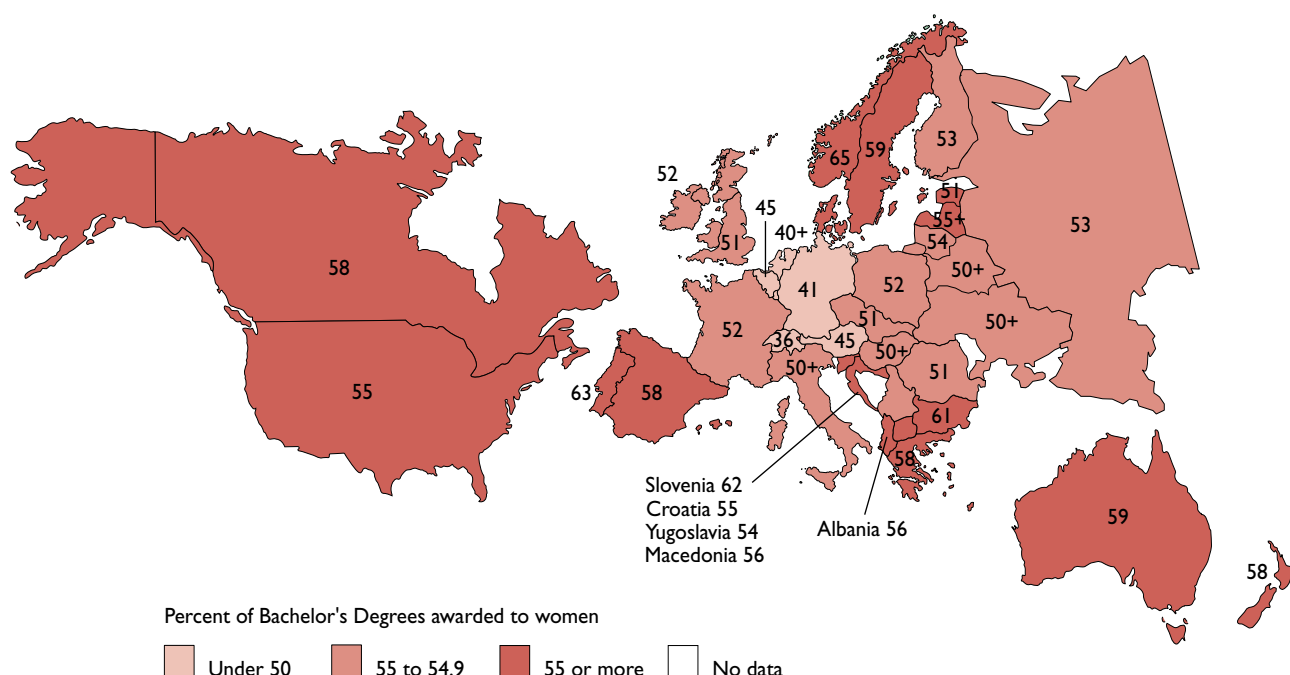
The major difficulty encountered in reviewing the position of women in science in the EU today is the lack of systematically collected and published statistics. Many employers and managers of science and technology in Europe do not routinely collect gender disaggregated statistics; nor do they take advantage of gender monitoring as a human resource and management tool. Where figures are collected, they are not always published. Where they are published, they are not always presented in a manner that makes it straightforward to see the gendered picture. Where statistics are collected, presented and arranged systematically, there can be problems of interpretation in the absence of other data. These difficulties in establishing a clear picture at Member State level are further compounded by problems of making comparisons across Member States. This has been identified as a crucial issue in all the major documents on women in science at European and Member State level referred to in the previous chapter. Indeed, the issue of statistics is so crucial it is addressed separately in Chapter 8 where it is also argued that equality indicators need urgently to be developed.

Lack of women in top jobs in science throughout the EU

Despite these difficulties, this section uses such figures that are available to give an indication of broad patterns of the position of women in science.

Some immediate facts are striking. Women science professionals tend to work in the public sector, especially in universities, rather than in the private sector (Talapessy, 1993, p 13). Throughout the EU, despite the increased participation of women in higher education, and despite the increase in women taking science subjects and moving into doctoral and postdoctoral studies, there remain remarkably few women in top jobs in science in any of the Member States. Moreover, notwithstanding the fact that different systems and cultures operate in the respective Member States, with one or two exceptions, the overall percentage of women in top science positions is extraordinarily similar. Crucially, there are remarkably few women on important scientific committees and in key policy-shaping arenas (see Chapter 5).

Figure 2.1: Percentage of bachelor's degrees awarded to women



Source: Copyright Rodger Doyle, reprinted from *Scientific American* (October, 1999, p 22)
Data are for bachelor's or comparable degrees and apply to 1996 except for Bulgaria, Lithuania, Slovenia, Slovakia, Macedonia, and Yugoslavia, which are for 1997; Denmark, Finland, Germany, Portugal, Russia, Spain and the UK, which are for 1995; and Belgium, France, Greece and Switzerland, which are for 1993. Data for Belarus, Hungary, Italy, Latvia, the Netherlands and Ukraine are estimates for the mid-1990s based on enrolment data.

'It is wholly unacceptable that Britain's universities should remain bastions of male power and privilege. All universities should take steps to ensure women's fair representation, and should monitor and publish information about women's progress. Oxford and Cambridge, centres of academic excellence in Britain and worldwide have particular need to take positive action'

Hansard Society Commission on Women at the Top (1990)

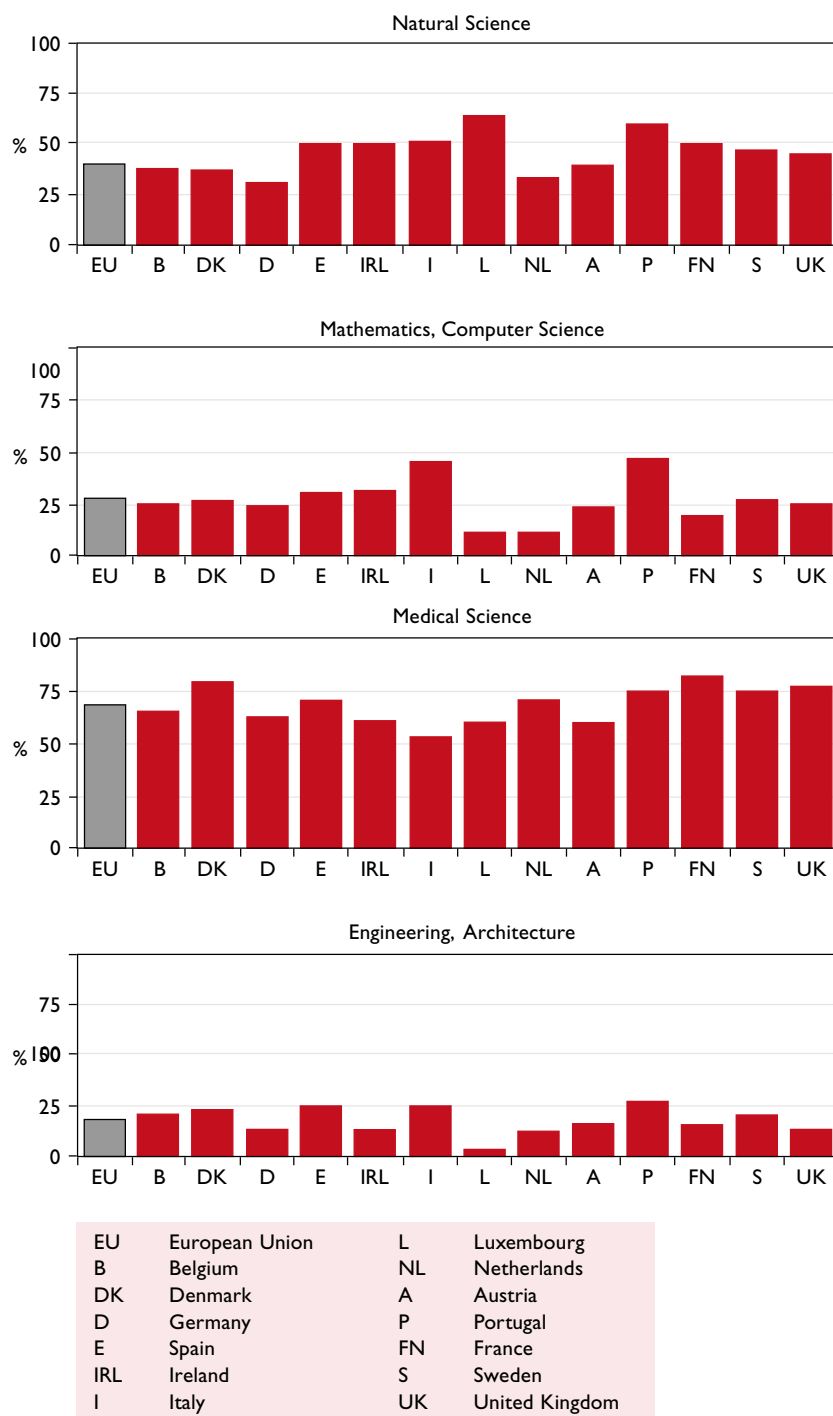
Universities

Some general comments can be made to summarise the picture, beginning with the picture of women in universities in the EU:

- women now constitute 50% of first degree students in many countries (see Figure 2.1 and Figure 2.2);
- they tend to disappear from academic life before obtaining careers posts (such as tenure, where it exists);
- the higher the position in the hierarchy, the lower the percentage of women;
- the percentage of full professors who are women is very low, ranging from 5% in the Netherlands to 18% in Finland;

- there are considerable variations in the proportion of women between disciplines; and
- those disciplines with hardly any women in most countries such as theoretical physics, tend to be high status.

Figure 2.2: Percentage of students in higher education that are female by field of study 1994-95 in the EU Member States



Portugal tops the league for women professors

Portugal seems to have been extraordinarily successful in incorporating women into science departments at universities and research institutes. In the Science faculty at the University of Lisbon, 30.7% of the full (catedrático) professors, 58.9% of the associate (associado) professors and 57.2% of the assistant (auxiliar) professors are women. Women hold 33/73 (45.2%) of the principal investigator positions in three new research institutes:

- Institute for Cell and Molecular Biology, Porto (IBMC);
- Institute for Molecular Pathology, Porto (IPATIMUP); and
- Institute for Biotechnology (ITQB).

How has this come about in a country where, before 1990, there were practically no conditions to do research in life sciences in the country (with the exception of a private Research Institute funded by Fundacao Calouste Gulbenkian)?

Scientists employed by universities were faced with low salaries, a lack of infrastructure and no national funds for grant money. And during the 60s and 70s, all post-university males were forced to join the army to fight in Africa. This led to:

- a male preference for better paid careers (such as engineering, economics and law);
- a brain-drain of bright male scientists.

continued on next page

Reprinted from Annex 2 of the Communication from the Commission *Women and Science COM (1999)76 final*. (CEC, 1999)

Thus, a lot of positions in the universities started to be occupied by women.

The CIENCIA Programme (500 million euros funded 75% by the EU and 25% from Portugal) resulted in:

- new research institutes such as IBMC, IPATIMUP and ITQB being built and fully equipped;
- an enormous increase in the number of young people (both female and male) attracted to science due to the possibility of getting fellowships; and
- the establishment of a system to fund research grants.

The second Programme, PRAXIS XXI runs from 1994 to 2000.

Again, the budget of 525 million euros is composed of 75% EU funds (coming from FEDER) and 25% national funds. The money is distributed by the Fundacao Para a Ciencia e Tecnologia, using the national peer review system. In this programme, the priorities are:

- Research grants;
- Fellowships (the first post-doc fellowships were introduced in 1994 and the plan is to start soon with an additional fellowship program for young group leaders).

(Contributed by Maria Carmo-Fonseca, University of Lisbon)

The percentage of faculty of different ranks that are women for all disciplines combined is shown in Table 2.1. Comparison of the figures at full professor level shows a rather dismal picture. Even in the top scoring Member States, such as Finland, France and Spain, women now make up only about 13%–18% of full professors. Elsewhere, such as Austria, Belgium, Ireland, the Netherlands, Germany and Denmark, women only constitute 7% or less of full professors. Women are found in higher proportions among Assistant Professors and Associate Professors but again, in almost all EU Member States, they constitute only a minor proportion of the professoriat in these ranks.

Table 2.1: Women professors: Percentage of faculty that are women (Different ranks, all disciplines)

Country	Year	A (Full)	B (Assoc)	C (Assist)
Turkey	1996/7	21.5	30.7	28.0
Finland	1998	18.4		
Portugal ^a	1997	17.0	36.0	44.0
France	1997/8	13.8	34.2	
Spain	1995/6	13.2	34.9	30.9
Norway	1997	11.7	27.7	37.6
Sweden	1997/8	11.0	22.0	45.0
Italy	1997	11.0	27.0	40.0
Greece	1997/8	9.5	20.3	30.6
UK	1996/7	8.5	18.4	33.3
Iceland	1996	8.0	22.0	45.0
Israel	1996	7.8	16.0	30.8
Belgium (Fr)	1997	7.0	7.0	18.0
Denmark	1997	7.0	19.0	32.0
Ireland	1997/8	6.8	7.5	16.3
Austria	1999	6.0	7.0	12.0
Germany	1998	5.9	11.3	23.8
Switzerland	1996	5.7	19.2	25.6
Belgium (Fl)	1998	5.1	10.0	13.1
Netherlands	1998	5.0	7.0	20.0
Australia	1997	14.0	23.0	40.7
USA	1998	13.8	30.0	43.1
Canada	1998	12.0		
New Zealand	1998	10.4	10.2/23.5	45.5

Updated from Osborn (1998)

The countries are listed according to the percentage of full professors that are female.

Note: Belgium keeps two sets of statistics, one for the French (Fr) and one for the Flemish (Fl) part.

^a Portugal. Numbers include only academic staff performing R and D activities.

Note: for sources of figures and notes to Table, see Appendix III.

With some exceptions, women appear to fare better in scientific professions in Southern EU Member States than among Northern ones (see Table 2.1). There are variations in patterns of economic activity over the life-cycle among women in the various Member States. Hence while career breaks and part-time working are common in some Northern European countries such as the UK, and the Netherlands, elsewhere, for example, Spain, France and Italy, women are much more likely to work full-time and throughout their adult life. Systems of support and cultural expectations reflect and create these differences. The subject needs further research (see Rubery et al, 1998).

Variations over time

The figures in Table 2.1 give only a snapshot impression. The increase in percentage of female full professors over time is shown for several countries in Figure 2.3. In many countries the percentages remained static during the 1980s but began to show a slow steady increase at the beginning of the 1990s. Occasionally, because of special circumstances there is a dramatic increase. For example in Finland, in 1998, all associate professors were promoted to full professor resulting in an increase in the proportion of women from 13% to 18% in a single year. Equally, the end of the 'binary divide' between universities and polytechnics in the UK for example, enhanced the numbers of women chairs as women were more likely to be found in senior positions in the institutions that became new universities.

In the Netherlands, the restructuring of the senior tiers of academia caused a serious set back for women:

'But even in the long-industrialised European countries, the story has not been one of automatic growth. Thus in the Netherlands... the situation for women academics has deteriorated over the past two decades. Where in 1970 there were 2.7 per cent women professors, by 1980 this was down to 2.2 per cent and by 1988 to 2.1 per cent. But the Netherlands is a small country, and the raw figures are more graphic: thus where there were 65 women professors in 1970, by 1988 there were only 50. The middle rank from whom the professoriat is recruited had also shrunk, in this case from 312 to 105 women' (Rose 1994, p 103)

An important statistic is the percentage that women form, per year, of new appointments at each level. Only then can one calculate the rate at which change in the overall numbers is likely. We were able to obtain this statistic for only two countries:

- *Poland:* Women were 9.4 % of those given the title of Professor in 1977, 16.6 % in 1988, 20 % in 1990 and 21.9 % in 1996.
- *Germany:* In 1997, 12.4% of those appointed at the C4 (or full professor) level, and 17.8% of those appointed at the C3 (or associate level) were female. In 1998, 9.7% of those appointed at the C4 level and 17.3% of those appointed at the C3 level were female.

Assuming that a C4 professor occupies the post for an average of 18 years, and that around 5.5% of C4 professors are women, appointments at a rate of around 13% per year will lead to an increase of around 0.5% per year, under normal circumstances. Indeed this is the rate for Germany seen in Fig 2.3. Doubling the proportion of appointments that go to women at this level would double the rate of increase.

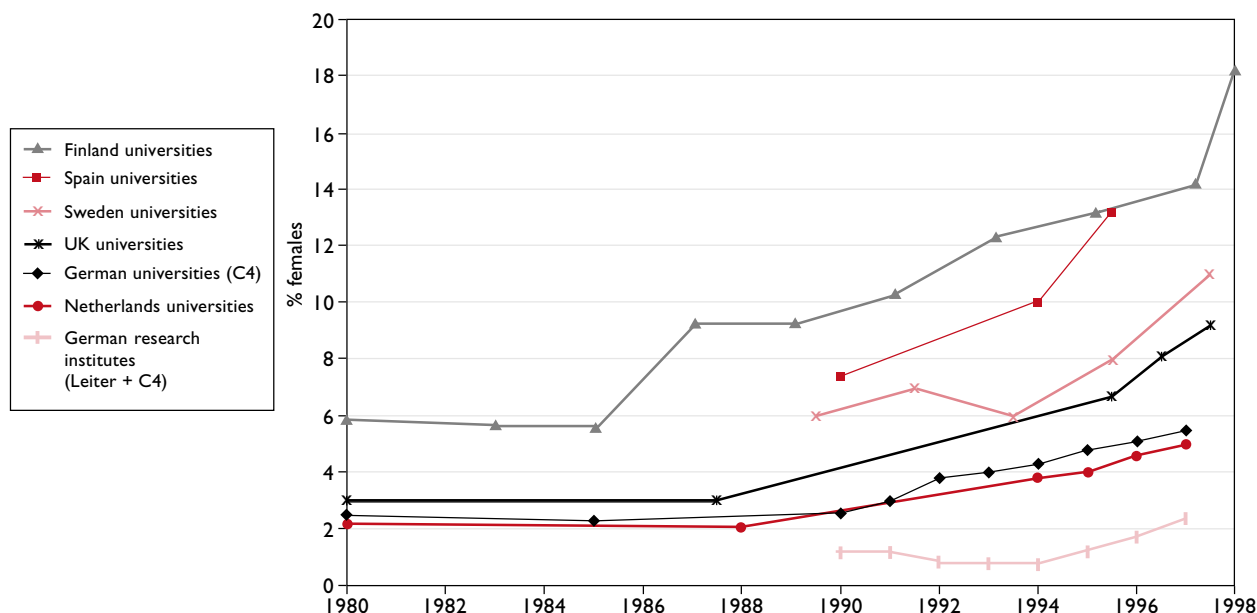
Women and science beyond the EU

The report concentrates on women in Member States. There are however two additional blocks of countries for which data and analysis would be of special interest.

- the 15 associated states to the Fifth Framework Programme that include the Central and Eastern European countries. For these countries, it would be important to know both the current status of women in science as well as how this has been affected by recent social, economic and political changes.
- the countries of the INCO MED programme which include the non-Member States around the Mediterranean. In some of these countries improvements for women in science need necessarily to be linked to a longer process in which educational measures are clearly very important.

On average in the EU, percentages of women professors seem to be increasing at a rate of 0.5 -1.0% per year. Clearly, *waiting* for a gender balance among the professoriat in European universities is not a particularly effective strategy.

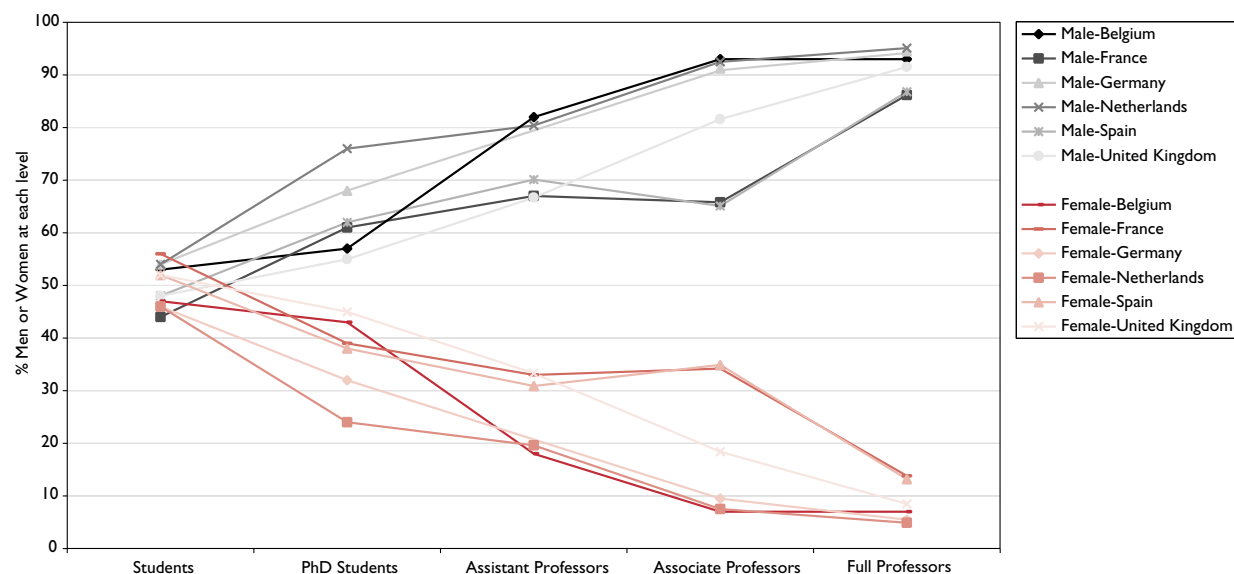
Fig 2.3: Women professors over time: Percentage of professors who are women in different Member States (1980-98)



Source for data see page 137

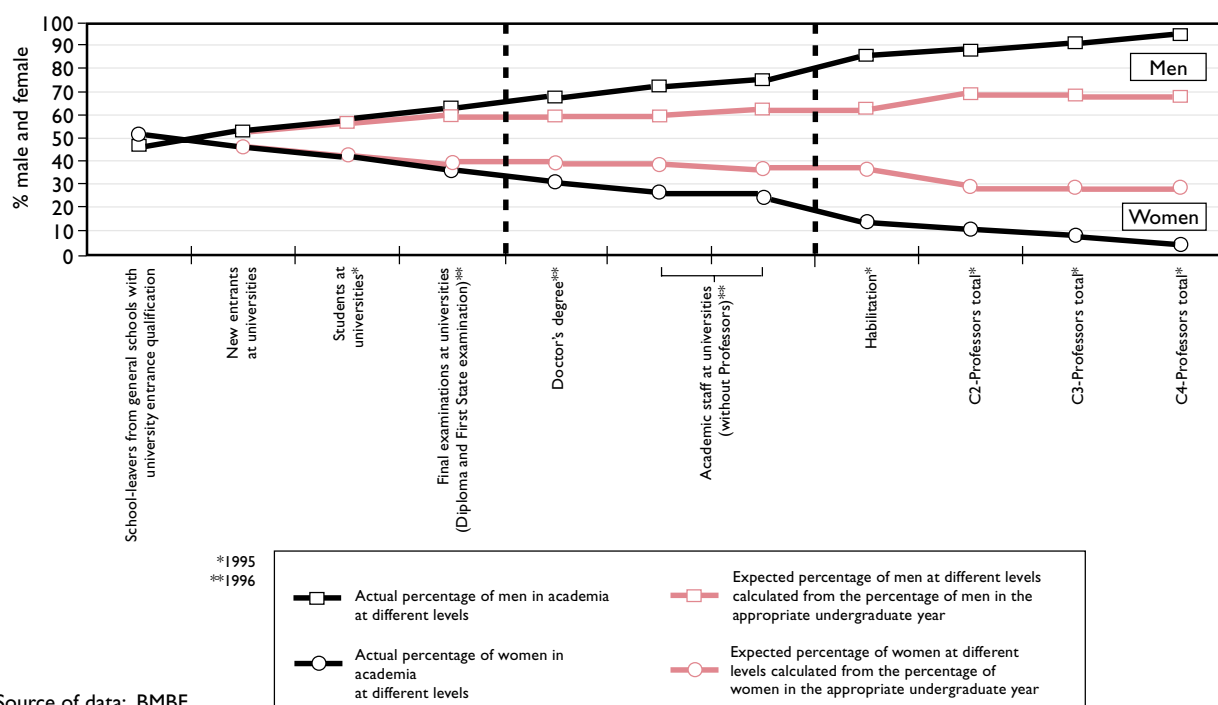
The leaky pipeline

Women are lost from the academic pipeline at a greater rate than their male counterparts. This is amply documented in Figures 2.4 to 2.6. Currently, the proportion of men and women among undergraduate students is broadly similar for the six Member States for which data are shown (Figure 2.4). However, the proportion of women declines markedly at the post-doctorate level, where career tracks begin. In those Member States that offer tenured positions, for example, this is where the drop in the numbers of women occurs begins. For each step up the ladder hereafter, the proportion of women declines. The drop in women both at the post doc level and after it has been attributed to a 'leaky pipeline'.

Figure 2.4: Women and men in science in six Member States (1997)

Source for data see page 137

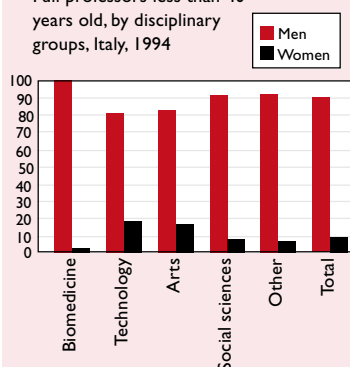
Figure 2.4 shows the proportion of men and women at each stage of the academic career in 1997. It compares them to the proportion that one would expect to find given the numbers of men and women undergraduates in prior years, based on the assumption that men and women were equally likely to stay in the system and to progress through at equal rates. It shows clearly that the lack of women at the top levels cannot be explained by a lack of women in the corresponding undergraduate classes. Indeed, Figures 2.4 and 2.5 both indicate for a range of Member States (where data were available) the astonishing impact of gender on the *outcome* of scientific careers. To ignore these patterns is to accept discrimination in the sciences.

Figure 2.5: Women and men in science in Germany: The scissors diagram

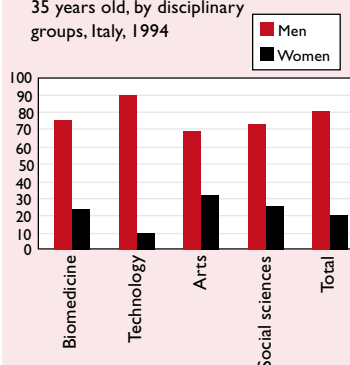
Source of data: BMBF

It is often said that the gender imbalance among scientists in universities is due to the fact that women entered the career relatively recently. However, these figures from Italy show that even among younger age cohorts, gender still makes a powerful difference.

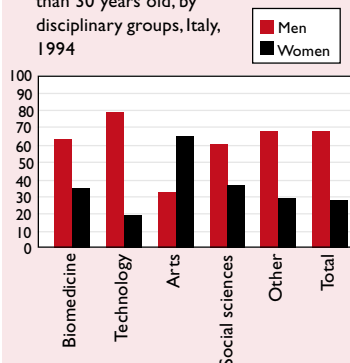
Full professors less than 40 years old, by disciplinary groups, Italy, 1994



Associate professors less than 35 years old, by disciplinary groups, Italy, 1994



University Researchers less than 30 years old, by disciplinary groups, Italy, 1994



Source: Rossella Palomba

The cohort data presented in Figure 2.4, and for Germany in Figure 2.5, show the shape of a pair of scissors. Women are the majority of students in the subjects shown, but men comprise the vast majority of senior post holders.

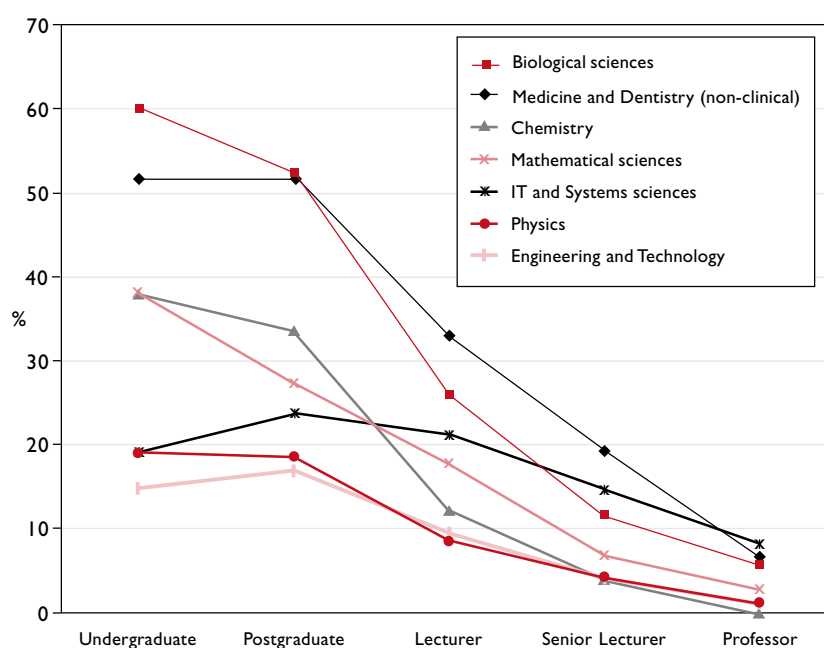
Variations by discipline

There are of course differences between disciplines and among countries. Cross-country comparisons are difficult since only some countries provide data broken down by discipline, and in any case disciplines are grouped differently in different countries (see Chapter 8 and Appendix III).

Nevertheless, it is clear that women are more likely to be found among social scientists and biological scientists than among chemists, physicists and engineers (see box on left). Hence, the percentage of full professors who are female is much smaller when specific disciplines such as natural sciences or engineering are considered. For natural sciences, estimates range from 9.3% in France, to 1% in Austria. For engineering, the figures vary from 4.6% in Italy to 2.1% in the UK (1997/8). Yet percentages do not tell the whole story. For instance, we get a more vivid impression from the fact that for engineering in the UK in 1994/5 there were 886 male professors but only 7 female professors! Currently there are only three women professors of chemistry in the UK and not one female professor of civil engineering.

The decrease in women's representation with increasing rank is a pattern that emerges across all disciplines. Figure 2.6 uses data from the UK to document this for all scientific disciplines. Nevertheless, there are huge variations in the percentage of faculty that are female when different universities are studied, even within a single Member State.

Figure 2.6: Percentages of women in science, engineering and technology in UK universities by field and level (1996-97)



Waiting for equality

One of the most common explanation of the under representation of women in the top grades of the scientific careers is that women are less numerous because they entered the world of scientific research more recently than men. But is it true? We examined a group of 1,088 senior researchers (78% men, 22% women) at the Italian National Research Council, all of whom entered the position in the same year: 1988. The senior researchers had the same mean age, 42.5 years. The aim of the study was to see how many men and women were promoted to the top grade – research director - after 10 years. We found that 26% of men as compared to only 12.8% of women arrived at the top, thus confirming that despite having the same starting point, men are more likely to be promoted than women. The imbalance was greatest at the top career grade: among the 240 research directors, 88% were men and 12% women.

It is important to note here that there is no guarantee that women will necessarily increase their share in particular disciplines with time – figures show a decline, for example, among computer science graduates over time in both Sweden and the UK.

Senior management positions in universities

Scientists often reach the top management positions in universities such as Rector or Vice Chancellor: the lack of women in senior grades in science therefore affects their prospects of achieving such high office. Recent figures show the paucity of women at the helm of European universities. This is a particular issue in France where, in 1999, women are a mere 4.5% (4/88) of University Presidents. In Germany, women comprise 5.0% of Rectors (11 out of 222, in 1998); 5.3% of Presidents (4/75), 11.2% of Pro-rectors (41/365), 17% of Vice Presidents (19/111) and 10.8% of Chancellors (30/277). In Spain, in 1999, women comprised 1.6% (1/61) of Rectors and 9.8% (6/61) of Vice-rectors. In the Netherlands, 5% (2/40) of university boards (President, Vice President, Rector) are female. In Sweden, by contrast, 18% (7/38) of rectors are female. In the UK, 5% of Vice Chancellors (5/104) are women. One fifth of Cambridge colleges (6/30) are headed by a woman compared with 15% of Oxford colleges (6/39). Overall, there is a dearth of women among the top management posts in universities. This has a number of consequences. Women are absent in debates shaping policy (discussed in Chapter 5); they are not there to provide a challenge to the status quo and *modus vivendi* and their absence means there are few role models for women coming up the system.

Research institutes

The gender imbalance in research institutes is similar to that in the universities. Thus, they display the familiar pyramid structure, with women occupying a greater percentage of the lower grades and relatively few of the top positions. Hence, the percentage of female senior staff in research institutes is usually comparable to or indeed less than the corresponding number given for full professors in the universities. Variation depends on the focus of the research institute and on the country in which it is located.

Equality and Quality in Enterprises

New management methods imported from USA are now been introduced into a certain number of multinational companies, and are favourable to women's employment. Companies like Schlumberger and Motorola have become conscious that their customer base in the twenty-first century will not be restricted to white men. Hence they have started to recruit women engineers and appreciate their talents. Deutsche Telekom is now linking 'Equality of Men and Women in (the) Enterprise' with the objective of 'Quality Improvement'. The aim of this new programme is specifically designed to appeal to up-and-coming female managers at all grades. 'We have made it perfectly clear that our aim is to increase the number of female managers significantly' said Dr Heinz Klinkhammer at the launch of the *Mentoring for Women* at Deutsche Telekom pilot project (3/11/1998). The objectives of this internal program specifically for women are to recognise, highlight and make use of potential; to improve communication between hierarchies, generations and sexes; to increase the number of female managers; to kick-start motivation amongst female employees and to increase the pool of up-and-coming managers.

At the top levels, the contrast between research institutes in France and Germany is striking. In 1997, in France, 21.7% (5/23) of DRO positions (the top level) at the National Institute of Health and Medical Research (INSERM) and 8.8% (14/159) of the DRCE (directeurs de recherche de classe exceptionnelle) positions (the top level) in Centre National de la Recherche Scientifique (CNRS) were held by women. By contrast, in Germany, in 1997, women occupied only 4.5% (6/134) of the 'leiter' positions and 1.6% (7/426) at the C4 level.¹

Figures on the gender distribution of group leaders (or principal investigators) at different international and national research institutes in physics and life sciences are also striking. At the European Laboratory for Particle Physics (CERN), 5% of group leaders, 7% of deputy group leaders and 10% of section leaders are female. At the Italian National Research Council (CNR), women make up 6% of the Directors of CNR institutes, Study Centres and National Research Groups. At the European Molecular Biology Laboratory in Heidelberg, and at the Medical Research Council (MRC) Laboratory of Molecular Biology in Cambridge, 12% of the group leaders are female. At the Basle Institute of Immunology and the Imperial Cancer Research Fund in London, around 20% of the group leaders are female. In the Max Planck Society, just under a quarter (24%) of 'junior groups' are headed by women. Similarly, at the Pasteur Institute in Paris, women head 23.9% of research units, while 2/9 of the department heads are female. And in three, newly founded life sciences institutes in Portugal, 45.2% of the principal investigators are female.

Scientists in industry

This is an area where it is extremely difficult to get figures. Let us take just one Member State and a single discipline: What do we know about women engineers in France? Surveys by the National Council of French Engineers and Scientists (CNISF) include a question on gender, and the particular situation of French women engineers has been analysed by the Association of French women engineers (AFFI). In 1995, 22.7% of the degrees awarded by the Engineering High Schools were given to women. Women engineers are more likely to go into teaching, research and development than their male colleagues, they are less likely to go into civil engineering and construction. It is impossible to get any data on women with a scientific education who are now leaders of scientific companies. French researchers in universities and large institutions are state employees; very few of them start their own company, least of all women.

The best rough estimate of the proportion of top positions in industry occupied by women in the EU, drawing on a range of sources is around 3%. Of the Member State statistical offices that we asked, only that of the Netherlands was able to provide an exact figure (1.5%). Information giving the percentage of women in senior management in a few companies in Germany is in Appendix IV. Again, the need for systematic data collection for industry at both national and EU levels cannot be overemphasised.

¹ Figures from the Bund-Länder-Kommission für Bildungsplanung und Forschungsförderung (BLK) for the Max Planck Society, the Fraunhofer Society, the Hermann von Helmholtz Association of German Research Centres and the Gottfried Wilhelm Leibniz institutions taken together.

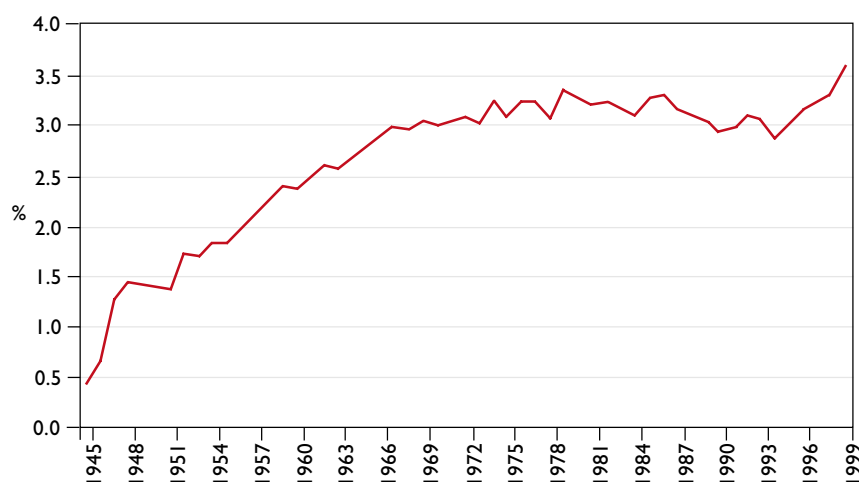
The story of a French woman physicist entrepreneur

A very rare example is the case of Dr X. With a PhD in physics and biophysics, she first managed a group on medical instrumentation development in the state owned Atomic Energy Commission (CEA). In 1985, in the framework of a start up policy of this institution, she founded her own company specialising in image recognition software, mainly in biology, for assisting diagnosis by procedures automation. Since 1984, only 63 companies have been created inside this CEA program, out of which only four are led by women. Dr X was the first such woman and the third such person. Every French researcher encounters obstacles when starting their own company, in particular insufficient knowledge of the business world. However, Dr. X says, a woman has the added difficulty of not being taken seriously: 'A banker does not trust a woman enterprise leader to manage of a budget of 1 million euros'.

The academies

Some academies are very influential, others less so. Many learned bodies are often asked for advice by governments and others. It is therefore important that both men and women scientists have access to this channel of communication. The lack of women in these bodies is extraordinary.

Figure 2.7: Fellows of the Royal Society of London, % women (1945-99)



Source: Compiled by Joan Mason.

In 1999, 5.6% of members of Academia Europaea were female. The percentages for the German Academies (4%), the Royal Society of London (3.6%), and the French Academy of Sciences (3.6%) are lower. A full breakdown of academy membership in EU Member States and elsewhere by gender is provided in Appendix V. It also lists the number of women found on the executive committee or council of some academies. This information had to be especially collected by network members; it was not available from any official body. The only conclusion to be drawn from examining the data in Appendix V is that women are very poorly represented in these bodies indeed. In addition, the data in Figure 2.7 suggest that at least for the Royal Society, the percentage of women is increasing only very slowly. The percentage of women in the European Molecular Biology Organisation (EMBO) is 9.2%

Building a future without discrimination

'Women and small and medium sized enterprises constitute the main weapons for helping us to build a future without discrimination. We fight for our rights, and not for privileges, because business has no gender. What is a natural success for men is a conquest for women.' Ms A. Diamantopoulou, Secretary of State, Ministry of Development, Greece (now EU Commissioner for Social Affairs in charge of equal opportunities) OECD Conference *Women Entrepreneurs in SMEs: A Major Force in Innovation and Job Creation*

Women and prizes

Only 11 out of 457 Nobel science prizes have been given to women since the establishment of the awards in 1901. However, many women worked in teams where other members were awarded the prize. Several major prizes have never been given to a woman. These include the Crafoord Prize, the Lemelson-MIT prize, the Japan Prize, the Charles Stark Draper Prize and the Jung Prize for Medicine. For other major prizes, women are only occasionally represented among the prize-winners.

'Recently, Massachusetts Institute of Technology (MIT) in the US admitted to having given the 15 female tenured professors in the School of Science less space, resources and salaries than their 197 male counterparts. In the four years since women faculty first suggested there was a bias MIT has responded by raising women's salaries an average of 20% to equal men's, increased research money and space, awarded women key committee seats within the institute and increased the pensions of the few retired female faculty to what they would have been had the salary inequities not existed. This report demonstrates the power of group rather than individual protest. The actions taken to correct the situation show the influence that can be exerted by administrators concerned with eliminating gender bias.'

Pardue et al, Nature web site on debates/women

<http://helix.nature.com/debates/women/>
see also: web.mit.edu/fnl/women/women

Major international and national prizes

Major science prizes not only afford recognition of scientific achievement but also, in some cases, provide considerable funding for the winner's research. In addition, the UK's Office of Science and Technology, in a document assessing the quality of the Science Base, used major science prizes as one criterion. For these reasons we decided to examine what share of such prizes have been given to women. The data are listed in Appendix VI.

Women awarded Nobel Prizes in science 1901-98

Physics 2/158

Marie Curie (1903), Maria Goeppert-Mayer (1963)

Chemistry 3/131

Marie Curie (1911), Irène Joliot-Curie (1935), Dorothy Hodgkin (1964)

Physiology or Medicine 6/168

Gerty Cori (1947), Rosalyn Yalow (1977), Barbara McClintock (1983), Rita Levi-Montalcini (1986), Gertrude Elion (1988), Christiane Nüsslein-Volhard (1995).

There are only three living female Nobel prize-winners (compared with 167 males) in the sciences:

- Rita Levi-Montalcini, an Italian-American neuro-biologist, who is 90 years old,
- Rosalyn Yalow, an American biophysicist, who is 78 years old, and
- Christiane Nüsslein-Volhard, a German developmental biologist who is 57.

Remuneration

Despite EU Directives on equal treatment on pay, there is a sizeable pay gap between men and women in all walks of life in all Member States. Again we are hampered by lack of systematic harmonised data, but such figures as do exist illustrate that women in science are paid less than men are. For example, the recent Bett review of academic salaries in the UK revealed quite shocking statistics. It found that women received less pay than men at every single grade throughout the university hierarchy. The report identified the gender pay gap as a serious issue and recommended that it be addressed at the earliest opportunity (Independent Review Committee on Higher Education Pay and Conditions 1999).

The American Association of University Professors issues a yearly document entitled the *Annual Report on the Economic Status of the Profession*. This lists the salaries paid to women and men at each rank in each academic institution in the US and thus facilitates a proper comparison. Such an approach would be helpful to gender equality in the EU.

In Europe, different Member States have different structures and rules governing pay and remuneration. In some Member States, transparency is obscured by the existence of 'additional payments' and 'honoraria'. This can mean that individuals officially at the same level can be being paid very different salaries.

The pay gap in the US

In the US, in 1998, the differences in salaries between male and female faculty at institutions giving more than 30 doctoral degrees a year were: full professor 9.4%, associate 6.2% assistant 7.5% and instructor 5.7%. These differences have remained more or less constant since 1975.

<http://www.aaup.org/wrepup.htm>

The pay gap in Germany

65% of the female but only 35% of male scientists at the Hermann von Helmholtz Association of German Research Centres are in the lowest salary band for scientific staff

There is some support for action on the pay issue both at the EU level, from the European Trades Union Congress, and within individual Member States, for example the Equal Opportunities Commission in Britain has launched *Valuing Women*, a high profile equal pay campaign. Such campaigns can be vitally important in persuading employers to ensure that they maintain and use effective databases to monitor and address any unwarranted gender differential on pay.

At Cambridge University, with its high level of research activity, 64% of teaching and research staff are on fixed term contracts. Women make up 40% of these but only 14% of tenured staff.

Casualisation of research careers

There is considerable variation among the Member States in how scientific careers are organised in research institutes and universities. In some, there has been a considerable growth in short-term contracts. This has been referred to as the 'casualisation' of research careers. Women are more likely to be among those on short-term contracts. In the UK, for example, 41% of higher education and teaching staff are now on fixed term contracts. Women are a minority of academic staff but are disproportionately represented among contract workers: they comprise 43.5% of contract staff but only 36.7% of tenured staff. There are dangers that such scientists become lost to the profession through their inability to get a secure position and that their work is affected by stress associated with uncertainty about their futures. In other Member States, such as Sweden, tenure is the exception rather than the norm but 'leakage' still occurs. There are also variations in the age at which a scientific career 'takes off' which makes cross-national comparison difficult. The various patterns have different implications for women in terms of how they integrate career breaks into their professional lives. Career planning can also be complicated by structural barriers present in some countries, such as the Habilitation degree that has until recently been considered an essential qualification for professors in Germany, Austria and Switzerland.

In Greece 38% of those on short term contracts are women (as opposed to 35.9% of lecturers). Such contracts are normally for one year. Staff on short-term contracts have all duties in teaching and research that faculty members have but almost no rights. They are not allowed to have their own lab or to supervise (at least officially) PhD students. They are not entitled to any of the funds that come to the university from the Ministry of Education. They are only allowed to apply for grants and their salaries come from the Ministry.

Conclusions

In this chapter we have just drawn a rough sketch of the position of women in science, drawing based on such scant data that could be obtained. Further figures are provided on women and fellowship programmes and research funding in Chapter 4. The representation of women on committees that shape scientific research is documented and discussed in detail in Chapters 4 and 5. Throughout these reviews, there is the problem of the lack of reliable, readily accessible and harmonised data. There is also a clear need for in-depth studies to understand the processes that lead to the gender imbalances we outline.

Despite these problems, there is a clear picture. There are very few women in top jobs in either the universities, the research institutes or in private sector scientific enterprises. Women are rarely awarded top prizes, and only rarely appear among the lists of members of academies. Women are beginning to come into science but the leaky pipeline means that they are lost to scientific careers. Why should this be the case? The next chapter looks in more detail at quality and fairness in scientific professions.

Policy points

- **Need for systematic, reliable, harmonised data on women in science, education and technology.**
 - **Need for in-depth studies on processes that lead to gender imbalances.**
 - **Need for more research to understand the leaky pipeline.**
 - **Need for more research on the lack of women in top scientific jobs.**
 - **Need to abolish structural barriers to women such as the Habilitation requirement in German-speaking countries.**
 - **Need for transparency of payrates for men and women faculty members through regular, published pay audits.**
 - **Need to remove the gender pay gap.**
-

3 Quality and fairness in scientific professions

To ensure the highest quality of scientific research and teaching, it is vital that universities, research centres and employers recruit and promote the best people, and provide conditions and foster cultures where they can flourish. Recruitment and employment procedures need to be scrutinised to ensure they meet the highest standards of good practice. Unfortunately, some universities and research centres still operate archaic, opaque recruitment procedures for key positions, leaving themselves open to criticisms of dependence upon an ‘old boy network’ to secure succession routes. Patronage remains an important element of academic culture in some of our institutions. It is hard to assess its impact on the allocation of opportunities such as fellowships, posts and committee membership in the absence of transparent selection and recruitment procedures. However, it is vital to ensure that scientists of the highest quality are supported: open systems are more likely to identify them. The very best modern practices in hiring and firing need to be adopted to ensure merit is the sole criterion for appointment.

This chapter examines the shift from women’s exclusion from science to their segregation within it. It reviews policies to foster equal opportunities: equal treatment, positive action and mainstreaming. It also identifies key problems for women in scientific careers: the practice of head-hunting, the design of fellowships for single child-free individuals and the difficulty of returning to science after a career break. It concludes with some options for the future to promote equality, and thereby, quality and fairness in scientific professions.

Women in academe – from exclusion to segregation

The history of women in science in some countries is one of exclusion to segregation within certain disciplines and grades. This pattern is characteristic of women’s participation in public life more generally (Walby, 1986). Hence, in some Member States, women were legally prohibited from studying science until earlier this century. In the UK, for example, the Royal Society refused candidature to a woman in 1902 (being married, she was not a ‘person’ in law). No woman was put up again until 1943 when members took a vote to change the statutes.

Carbon copies

‘In Denmark one appoints a person who resembles oneself. The system reproduces itself. That is what is worrying’
‘If we leave this to the universities nothing will happen’
(Ministry of Research and Information Technology (1997) *Women and Excellence in Research* Copenhagen: Ministry of Research and Information Technology)

Slow progress

‘The worrying aspect from the point of view of equality between men and women in the highest research appointments are thus the slow increase in the proportion of women, the significantly low proportion of women appointed to the research posts at the research institutes, and the custom of appointing professors by invitation, which is clearly in favour of men’
(Academy of Finland (1998) *Women in Academia: Report of the Working Group appointed by the Academy of Finland* EDITA: Academy of Finland)

Women were not admitted to degree programmes on equal terms with men in UK universities until 1895. However, even after this date, while they were allowed to study, women were not permitted to take their degrees from Oxford or Cambridge universities (see photo). At Cambridge, women had been admitted to examinations as early as 1881, but not allowed to take anything but titular degrees until 1948. An MA degree would have given them a seat on Senate (until it was superseded by Regent House in 1948) and a say in university policy. Oxford admitted women to membership of the university in 1921 because it, along with Cambridge, was being investigated by a Royal Commission (set up in response to Oxbridge's request for public funds).

Cambridge set a 10% limit on women as a proportion of the student population while Oxford fixed a maximum of 25% women. Hence, both institutions totally ignored the 1919 *Sex Disqualification (Removal) Act*. Eventually, more women's colleges were built (in the 1950s) and men's colleges became mixed (from 1972). Women now constitute about 46% of students at Cambridge but 50% nationally.

Photo

Commemoration of the 50th anniversary of the full admission of women to the University of Cambridge in 1999 was marked by a ceremony at the Senate House in which women who had come up to Cambridge prior to 1949 participated. These women had not been able to take part in the university degree awarding ceremonies while at Cambridge. 1000 women now in their 70s and 80s took part.

Photograph taken by Gesa Mahne, copyright Newnham College, Cambridge.



The twentieth century saw the introduction of legislation designed to address such discriminatory practices. The 1957 *Treaty of Rome* established the principle of equal treatment of men and women in the Member States. Gender equality legislation introduced at the national level in the 1970s and 1980s made sex discrimination illegal. Now, at the beginning of the twenty-first century, men and women are found segregated into different areas of science. This segregation is:

- horizontal women are clustered in certain areas of science such as the biological and medical sciences,
- vertical women may constitute about half the undergraduates in some disciplines but they are a small fraction of the professoriat, and
- contractual men are more likely to have tenure; women are more likely to be on short-term and part-time contracts.

In Chapter 1, we identified three approaches to gender equality: equal treatment, positive action and mainstreaming. This section reviews some approaches taken under these headings in science, engineering and technology.

Equal treatment

Some of the more obvious and direct forms of discrimination against women have now been removed. These include the lifting of restrictions designed to prevent women from studying and taking degrees in science and from becoming members of academies and professional associations. Other, indirect forms of discrimination have largely been eradicated too, such as marriage bars that enforced women to resign their posts upon marriage. Age bars are an indirect form of sex discrimination as women are more likely to take career breaks for child-bearing and rearing. They were challenged in the 1980s in the UK but still exist for fellowships in many countries and for examinations leading to permanent jobs, such as CNRS and INSERM in France (see Chapter 9). In Germany, one cannot be appointed to a Chair in a university after the age of 53. There remain difficulties with conditions surrounding some research travel fellowships that are based on the assumption that the scholar will be a male, sometimes with a dependent spouse. In essence women now have the legal right to equal treatment including equal pay and this has certainly improved the prospects for women wanting to pursue a scientific career.

If the principle of equal treatment was applied properly, recruitment and promotion procedures would be transparent and follow good practice. As it is, some universities use networks and headhunters to fill posts (rather than the perfectly legitimate use to swell the pool of applicants). For example, in Finland, there has been some criticism of direct approaches being made to individuals on equal opportunities grounds since it results in fewer women being appointed. The increasing use of 'headhunting' techniques cuts across good equality practice.

As recently as the 1960s women were not even admitted to physics and astronomy graduate programs at Caltech, MIT or Harvard. In the 1950s: "Margaret Burridge recalls when the Carnegie Institute tried to ban her from observing with their powerful telescope on Mount Wilson in California. She had to go up the mountain with her husband a cosmologist who covered for her by telling officials he needed the telescope. While other astronomers on Mount Wilson stayed in a heated accommodation known as the monastery – complete with a chef- she recalls having to live in a little cottage and bring her own food."

Source: *Science* 252 1601 (1991)

Appointing professors

'As a minister I had the opportunity to read proposals for appointments to professorships. You would not believe with what kind of criminal energy women are kept outside such proposals. With all kinds of tricks, for instance, women scientists who would stand their ground in competing with men are not even invited for interview so as not to put a list of nothing but males at risk. This is the reality we are having to contend with. To me this is the second stage of the transposition of the principle of equal opportunity. First women were prevented from qualifying and now, when women are qualified, new methods are being used to avert competition.'

Helga Schuchardt, former Science Minister of the State of Lower Saxony, Germany

Cited in European Commission (1999) Women and Science – Proceedings of the conference Brussels April 28-29 1998 Luxembourg: Office for the Official Publications of the European Communities, p 141

Fair selection?



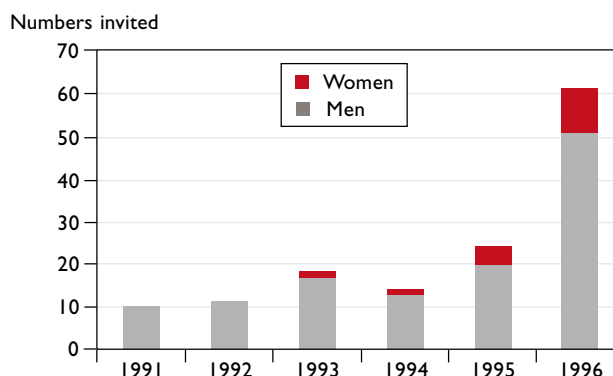
However, there is an important issue here in that in the name of equal treatment, women tend to be treated **the same as** men, rather than **equal** to them. This may sound pedantic! The crucial point is that men are taken as the norm: women are expected to behave like them and to have the same characteristics and life pattern. This point is illustrated in the cartoon. Women and men are not the same however. Stereotypical images of scientists tend to be of men (see Chapter 6). Science and scientists have a ‘gendered’ identity in the popular imagination.

Invited chairs

The practice of inviting persons to take on professorships has clearly become more common in the past few years. Whereas in the early 1990s less than 20 per cent of professors were appointed by invitation, by 1996 the proportion had risen to half.

Academy of Finland (1998) *Women in Academia: Report of the Working Group appointed by the Academy of Finland* EDITA: Academy of Finland, p 18)

Figure 3.1: Persons invited to the post of professor in Finland (1991-95)



Source: Academy of Finland (1998)

Reproducing the status quo

The majority of the rectors, deans and professors are men, the members of the foundation boards are mostly men. Most of the opponents and experts are men, this creates an image that the successful academic is a man. The decisions on what constitutes important, innovative research, what is worth sponsoring and developing, and which teams have a future are made by men. As a result, sponsorship is given according to gender-neutral results to teams that were good, or the researchers of the future are chosen according to male values.

Academy of Finland (1998) *Women in Academia: Report of the Working Group appointed by the Academy of Finland* EDITA: Academy of Finland, p 34 (from a survey participant)

Women and men are assumed to have different roles in the public and private spheres. These stereotypes influence assumptions about men and women and the appropriateness of roles they may wish to take up. In this context, science, technology and engineering are ‘gendered’ subjects. It is therefore important to recognise the extent to which the policy goal (which tends in any case to fall short of the reality) of treating women the same as men, in effect, advantages men. Hence, it is necessary to identify the ways and means by which current systems and structures indirectly discriminate against women. The privileging of unbroken careers in promotion rounds is an example of such discrimination: the assumption is made that applicants will not have their careers interrupted by child-bearing, so ‘merit’ becomes conflated with ‘experience’ which is read off from number of years’ service. Employers need to recognise that many male and female employees will have family responsibilities.

Equal treatment is a complex issue. At times, treating men and women the same can be discriminatory! For example, ignoring career breaks in appointments. At other times, treating men and women differently can be discriminatory. Sometimes it is necessary to act in a gender-neutral way, sometimes it is necessary to make a gender distinction. Crude approaches to equal treatment can backfire.

Positive action

Equal treatment does not produce equal outcome. As a consequence a raft of special measures have been introduced in most Member States to address the disadvantages experienced by women. In the well-worn clichés, they are designed to create a level playing field, or untie the hand behind women’s backs. They are intended to address women’s disadvantages so that

they can compete more effectively. While they are not always effective, and can attract backlash, some modest positive action measures can make a crucial difference. Such measures include projects designed to make science, technology and engineering more attractive to girls (see Chapter 6); women-only education and training courses; special encouragement to women to apply or the ring fencing of small numbers of opportunities or posts.

What can be done?

The give-away is that few of the women who make it to professor have children. As with high-flyers in many professions, the crucial breaks tend to come when people are in their thirties. Promotion depends heavily on publications. Anyone who has taken time out in these years – most of them women – risks being at a disadvantage. Overcoming this will mean taking trouble to encourage women to apply, taking careful account of the quality rather than the quantity of publications, and not penalising people who take longer to reach the professorial threshold. It can be done if people have the will. But have they?

Editorial in *The Times Higher Education Supplement*, 28th May 1999

Affirmative action can go wrong

An affirmative action programme adopted by the University of Amsterdam in 1988 focused on the recruitment of academic personnel. It was decided that women with *sufficient* (instead of *equal*) qualifications should be appointed to posts. The programme completely failed. A detailed analysis of five widely discussed and (in)famous appointment cases (conducted on the order of the Ministry of Social Affairs) found that the affirmative action measure proved to be disadvantageous to women. Quality, in the eyes of the scientists (and of opponents of such measures in general) was defined in terms of gender: either you are a woman - or you are good.

The University of Amsterdam gave up this programme (though formally it still exists) and instead came up with new measures to promote women in academia for which resources were earmarked (see *Other Measures*).

Examples of positive action measures include:

Fellowship programmes

- The Dorothy Hodgkin Fellowship Programme especially encouraged women to apply. Forty-five of the 48 awards made between 1995 and 1999 were given to women (for further details see Chapter 4).

Starting faculty positions

- In Germany, in 1999, the Hermann von Helmholtz Association of German Research Centres provided a framework in which their institutes can choose to create up to 100 additional positions from their running budgets to be used mainly for women in science. Using just such funds, the Research Centre Jülich established a tenure track programme for women. Beginning in 1999, each year, three female scientists will be offered a group leader position with a fixed two-year contract. In the subsequent consolidation phase, permanent contracts will be offered.
- The aim of the C1/C2 Programme of the Berlin Senate is to provide 60 of these faculty positions for women.
- In the Netherlands, the Organisation for Scientific Research launched the ASPASIA-Programme. Under this Programme, female assistant professors (junior lecturers) can apply for earmarked research funds.

Thirty such grants are available. Successful applicants are promoted to associate professor. The idea behind the programme is that the pool from which professors are selected should be enlarged. At the same time, the quantity of women who apply for research projects is enhanced.

- In Canada, the University Faculty Awards program encourages universities to appoint women to tenure-track positions in the natural sciences and engineering by funding 15, three to five-year awards per annum, plus a guaranteed minimum research grant.
- Also in Canada, 5 chairs were established for women in engineering. Initially for five years, they can be renewed.
- In the US, the Clare Booth Luce Professor Program established five-year tenure track appointments at the assistant or associate professor level in fields such as physics, chemistry, biology, meteorology, engineering, computer science, and mathematics. So far, 68 awards have been made.

Higher Level Positions

- In Sweden, 31 posts at the full professor level were created specially for women in 1995. Men were allowed to apply but could only be given the job if there was no suitable female candidate. The difference that such a programme can make can be illustrated by reference to the Royal Institute of Technology in Stockholm, which received three of these positions. The number of female professors was increased from three to six (out of a total of 160) and one of the new appointees was made vice chancellor in 1998. It should be noted that currently there are more than 1,700 professor posts in Sweden. (Jordansson, 1999)
- In Germany, the Max Planck Society is providing nine, five-year positions at the C3 or associate professor level to exceptional women nominated by individual institutes and paid for from private sources. When all are filled, this will double the number of women who occupy such posts.

Websites

The rise in home computers provides an opportunity for women wanting to return from career breaks to access websites to assist them. In the UK, the Association of Women in Science and Engineering (AWiSE) launched an Internet site that includes a Personal Development Planner. This is designed to help women identify their competencies and so build their confidence.

For returners

- The Daphne Jackson Programme in the UK supports women wanting to return to a scientific career.
- In Germany contact stipends, re-entry stipends and work contracts have been provided to enable scientists who interrupt their careers to return: the overwhelming majority went to women.
- Contact fellowships and childcare supplements to fellowships have also been provided (see Appendix I for further details).

Grants made preferentially to women – The Freja Initiative

- The Danish Government provided 10.5 million Euro over a period of four years starting in 1998 for the FREJA (**F**emale **R**esearchers in **J**oint **A**ction) Programme. The aims of the Programme are to give the young generation of researchers (particularly female researchers), an opportunity to pursue innovative research goals in all scientific areas, to encourage more young female researchers to pursue a research career, and to make female researchers more visible in the research world. In 1998, there

were 327 applications, 303 of which were from female applicants. The total amount of money requested by all applicants was 296 million euros. 16 researchers received grants from the programme (averaging 0.5 to 0.8 million euros) of which 15 were women. The level of interest in the FREJA programme in terms of the number of applications submitted is unique in the Danish context and shows that there are highly qualified female researchers within all scientific fields.

Other measures

- At the University of Amsterdam, the Stimulation Fund supports women to do research abroad, or to free them from teaching so they can finish their doctoral theses. It is also possible to use this fund to promote women from assistant professor to associate professor and from associate professor to full professor positions if certain quality criteria are met and if the faculty is prepared to continue the position after three years. From 1994–1996, six women professors and three associate professors were so appointed. Recently, this programme was singled out as the only such example of good practice in the Netherlands since its effect could be measured in terms of a rise in the number of professors and associate professors.
- In Germany, innovative pilot projects encouraging women to participate in scientific and technical studies have been supported. An example is the *‘informatica femminile’*, a summer university for women studying computer science at Bremen University. The International Women’s University for Technology and Culture within the framework of the EXPO 2000 is to provide 900 women researchers from all over the world with the opportunity of exchanging experiences at an interdisciplinary level for 100 days.

Essentially these projects address women’s disadvantage experienced as a result of the failure of equal treatment to deliver equality. Such positive action measures are to be welcomed but like equal treatment, they are limited in what they can achieve. They assist small numbers of women to fit into the status quo. Sometimes they backfire and provoke accusations of tokenism, or backlash. To make a significant difference to the picture outlined in Chapter 2, a transformative approach is needed to complement equal treatment and positive action.

Mainstreaming

Mainstreaming is a long term strategy. It focuses on transforming systems, structures and cultures, on integrating equality into policies, programmes and projects. It is a massive agenda of organisational and cultural change (Rees, 1998). It is also of course EC policy and has been signed up to by the Member States.

How might a mainstreaming approach affect women in scientific careers and indeed science itself? The first step is to identify the subtle ways in which the status quo in effect is designed with men in mind, the second is then to open systems up to accommodate men and women equally. For example, as mentioned earlier in this section, the promotion system is predicated upon a model of an uninterrupted career. It is very difficult for women who have had a career break to compete with men on an equal

Dual career couples - the 'two body problem'

This is the difficulty couples face when they need to find two jobs in the same geographic area. In the US, the problem is particularly acute for married female physicists since 43% have a physicist spouse, whereas only 6% of married male physicists have a physicist spouse. A recent survey of dual career couples in science in the US suggests possible solutions and discusses the advantages and disadvantages of each.

Solutions include shared or split positions, institutional hiring programmes for the spouse, finding an alternative position in or outside academia for the partner, as well as 'commuter marriages'.

Although many dual career couples in science face similar problems in Europe, institutions rarely take these into consideration when making appointments. Lack of professional opportunities for the spouse, or nepotism rules in institutions, may cause a candidate to reject a job offer. It may also cause the less experienced partner - often the woman - to drop out of science, or accept a job in which his or her talents are underused. Open discussion of this problem which contributes to the loss of highly trained women from science, as well as of measures to alleviate it, are long overdue in Europe.

(for details of the US study by Laurie McNeil and Marc Sher, see <http://www.physics.wm.edu/dualcareer.html>)

basis. Selection and promotion procedures need to ensure that women are not disadvantaged by career breaks. This means a more sophisticated measurement of quality and productivity than longevity of service. Counting a candidate's number of publications may in effect be more a measure of years' service and access to unlimited time, rather than productivity. Similarly, the differential in the size of men and women's research teams will have an impact on number of publications.

The leaky pipeline described in Chapter 2 means that women are lost to science just as they complete their education and have the most to contribute. Such data illustrate that the maxim 'we only have to wait for equality, because there is now a better gender balance among first degree students' holds no water. More dramatic measures are needed.

There have been two relevant examples of mainstreaming strategies in science targeted at the recruitment issue. The first, which has been used in Sweden and in Switzerland, sets targets for appointing women based on the proportion of women present in the pool of recruitment, that is, the next level down on the academic ladder. The second was developed in Germany and is designed to increase the number of women eligible for professor positions starting in the year 2000. Many new professors will be needed then because of retirements. The HSP II (started in 1991) and III (started in 1996) programmes are thus designed to address both the demographic problem of a large number of retirements and to increase the proportion of women professors. This initiative is part of a wider package of mainstreaming tools introduced in Germany (see Appendix I for a detailed description). Further examples of how a mainstreaming approach might be developed are presented in Chapter 9.

Good practice in recruitment, selection and promotion

This chapter has been concerned with the position of women in scientific careers and the identification of some of the practices that cut across good equal opportunities. It is clear that gender has an impact on who gets offered career track posts, who gets offered and can take up fellowships and who gets promoted. Universities and research institutes need to examine their policies and ensure that they have methods of assessing merit that are not informed by stereotypical images of scientists or of women and men. They need to guard against the use of the old boy network and patronage in the allocation of jobs. Transparent systems of recruitment and promotion are essential. Good gender equality practices should be implemented and adhered to where they are not already. These include advertising all posts, clear job and person specification, gender audits on pay, benchmarking to keep aware of best practice and positive action measures to address disadvantage, such as mentoring, networks and women-only opportunities. It is also essential that employers adopt or develop family friendly policies: these are discussed in Chapter 7.

Networks for women in science

In the 1960s in the USA, there was a growing concern to improve women's contribution to science and engineering. In 1971, women scientists founded

the Association for Women in Science (AWIS), dedicated to achieving equity and full participation for women in science, mathematics, engineering, and technology. After much lobbying from women scientists and their allies, the US Congress passed an Act in 1981 to promote *Equal Opportunities for Women and Minorities in Science and Technology*. This instructed the National Science Foundation to mount an affirmative action programme, and to report on the current situation biennially.

In the UK, 1984 was declared WISE year (Women into Science and Engineering) by the Equal Opportunities Commission and the Engineering Industry Training Board, the activity continuing subsequently as the WISE campaign to attract girls to engineering. Later in the 1980s, the Institute of Physics and the Royal Society of Chemistry set up committees (Women in Physics, the Women Chemists' Committee) in response to their observation that women members were dropping out of the profession at around the age of 30. They investigated this question in some depth, and work now as networking bodies, helping women to survive as scientists, and encouraging girls to take up science.

Networking for mutual help and support and the sharing of information is particularly valuable. The example of US AWIS was noted during the drafting of *The Rising Tide*, and the Government's response indicated it 'looks forward to the work in this area of the newly formed Association for Women in Science and Engineering' – AWiSE. AWIS, which has over 70 local chapters in the USA, from Alaska to Hawaii, set up a *Mentornet* with sister bodies, universities and industrial corporations. There are now several comparable associations to AWIS and AWiSE: WITS in Ireland, SCWIST (Society for Canadian Women in Science and Technology) in western Canada, TWOWS for women in the Third World, AWIS in New Zealand, SA WISE in South Africa, and WISENET in Australia.

In the UK, the Women's Engineering Society has been going since 1919, while women mathematicians have formed strong international links based on email, with annual meetings. AWiSE fills a particular need for numbers of women biologists and biomedics, and for women in science education, administration and the media, as well as providing a forum for broad discussion in meetings and in the electronic media. The need for AWiSE was shown dramatically by the spontaneous appearance of AWiSE branches from the grass roots, when the idea of AWiSE was mentioned in reports of *The Rising Tide* in 1994. The national body was launched, effectively, in 1998, with the launch of its website <www.awise.org> and quarterly journal *Forum*. A new task is to form a *MentorRing*, co-operating with sister organisations and others, to help girls and women progress in science.

The European Social Fund

The European Social Fund is one of four EU Structural Funds. Its purpose of is to co-finance schemes for human resources development. It can be used to help people to get (back) into the labour market and also to support people who already have work by improving their professional prospects. The need for a systematic gender breakdown of beneficiaries of the European Social Fund has been highlighted in a number of studies (Lefebvre 1993, Rees 1998) and is likely to be attempted more rigorously in future following the Mainstreaming Communication (CEC 1996) and the reform of the Structural Funds.

The possibility of using money from the ESF Social Fund to support women in science is well illustrated by a model project initiated by Marion Bimmler at the Buch Research Campus in Berlin. This project, for which 65% of the money comes from the European Social Fund and 35% from German sources, has provided funds for the retraining of 97 scientists (58 women) between 1997 and 1999. Some 80% of these scientists have already obtained new contracts paid for by other sources at the end of the retraining period. The scheme has been so successful that similar programs for retraining scientists have been started in other ex-DDR states, in which currently some 280 scientists are participating. The EU Commission is also thinking of extending this scheme to other less developed regions after the year 2000 (see *Nature* 395, 104, 1998).

New regulations for the years 2000–2006 will ensure that the Social Fund is used to promote four core themes: employability, entrepreneurship, adaptability and equality of opportunity between men and women. To do so, the Social Fund will have a total budget of around 70 billion euros. The new draft European Social Fund regulation defines the general policy fields in which the Fund can intervene. These include five areas to do with employment, social inclusion, education and training systems. In particular the Social Fund can be used to increase the participation of women in the labour market, including their career development and access to new job opportunities and entrepreneurship. Applications to the Social Fund are made by Member States rather than by individuals. Co-financing has to be found from national sources. Nevertheless, the Social Fund provides a useful opportunity to initiate projects of benefit to women in general, and to women in science in particular. Starting in 2000, equal opportunities will also be introduced into all aspects of decision making, project selection, monitoring and evaluations of projects supported by the Social Fund.

Contact details for the European Social Fund, and for its representatives in each of the Member States can be found at:
<http://europa.eu.int/comm/dg05/esf/en/index-htm>.

Conclusion

Gender is a key organising principle in scientific institutions to the detriment of science. The issue needs urgent attention. ‘Waiting’ for equality will not work: indeed the position of women is worsening in some areas. Calculating how many men would need to be dismissed and replaced by women to achieve a gender balance is intriguing (see Chapter 8) but not lawful or practical. The rigorous application of the principle of equal treatment would make a difference but would not be sufficient. Good male scientists should have nothing to fear from transparent, fair and effective recruitment and promotion practices. More positive action projects such as those identified above to kick-start the gender equality agenda are essential but not sufficient. A conscious effort needs to be made by employing institutions to address the underlying structures and systems, which disadvantage women. These include acknowledging how ‘merit’ and ‘productivity’ are social constructs predicated upon male patterns of working, and making institutions less reliant on male networks to secure succession plans. The balancing of work and life needs to be tackled by universities and research institutes (see Chapter 7).

Policy points

- More scientific methods of assessing merit, quality and productivity.
 - Transparent and fair selection and recruitment practices; all posts to be advertised; job and person specification for all posts.
 - End of use of patronage to fill posts and jobs tailored to fit particular candidates.
 - Gender disaggregated statistics on applications, recruitment and promotion.
 - Positive action measures to kick start organisations with very low numbers of women applicants and awardees.
 - Addressing the situation of careers for the woman returners.
 - Support for networking among and with women scientists.
 - Use women's networks to circulate information about appointments and funding procedures.
 - Women already in science to be treated equitably, given equal resources and included in decision-making roles at every level in the institution.
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4 Fairness and funding/ modernising peer review

Peer review is the system of evaluation by which the majority of grants and other resources necessary for conducting research are distributed within the research community. It is also used to review the scientific merits of academic papers and books. Peer review is a key element of academic life and an important mechanism in the safeguarding of excellence.

Anonymous refereeing is a highly respected part of the culture of science world-wide. The peer review system should ensure that the best projects and best scientists are funded and the best research is published. However, recent research has shown that there are flaws in the way the system operates. Systems need to be checked for gender biases in design or implementation. Sometimes – as shown by the Wennerås Wold study discussed below – they can go wrong.

The evaluation process relies on the notion that research colleagues (peers) are the best equipped to judge other scientists. However, it also relies on the rather naive assumption that evaluators can rid themselves of prejudice prevailing in the society at large and perform perfectly objective judgements. This chapter reviews the operation of the peer review in the allocation of post-doctoral fellowships and the funding of research grants, showing how, although it is ostensibly gender-neutral, the system can be flawed, to the detriment of women and good science.

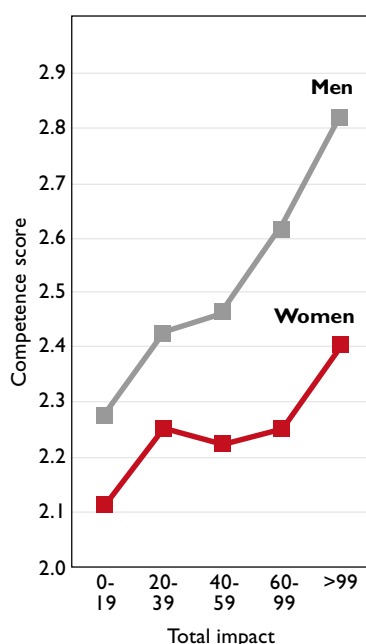
Post-doctoral fellowships

Post-doctoral fellows form a homogeneous group of scientists at a similar stage in their careers. How does the peer review system operate in the allocation of these sought after positions that open up career tracks? What is the gender distribution of post-doctoral awards by different national and international organisations?

‘Nepotism and sexism in peer review’

The shortcomings of the system were revealed recently in a study in Sweden conducted by two women scientists who took advantage of Swedish law that allows access to public papers. Christine Wennerås and Agnes Wold conducted a study of the Swedish Medical Research Council’s (MRC) evaluation process in order to elucidate why it was twice as likely to

Figure 4.1: Mean competence scores given to male and female applicants by the Swedish MRC



Note: The mean competence scores are plotted as a function of scientific productivity, measured as total impact. One impact point equals one paper published in a Journal with an impact factor of 1.

Reprinted with permission from *Nature*, vol 387, pp 341-3 (1997)

grant a male applicant a post-doctoral position than a female one. The applications for awards for postdoctoral positions in 1995 (52 women and 62 men) were investigated. The 'scientific competence' of the applicants had been judged on a scale from 0 to 4 by the MRC evaluators. Women obtained lower scores on average for scientific competence compared to their male colleagues. Using multivariate analysis, the competence score given to an applicant was related to a number of characteristics of that applicant, including scientific productivity (number and impact factor of papers, citations in scientific press, etc.), gender and research field. Three factors were found to be independent determinants of high scores for 'scientific competence':

- the applicant's scientific productivity;
- gender (male applicants received higher competence scores than female applicants with equal productivity), and;
- affiliation with one of the peer review committee members (applicants with such ties, who had been supervised by one of the evaluators for example, obtained better scores than other applicants exhibiting equal productivity).

The extra competence points allotted male applicants because of their gender corresponded to 20 extra scientific publications in excellent specialist journals. Thus, compared with the average male applicant, a female scientist had to be 2.6 times more productive if both were to be perceived as equally competent (Figure 4.1)

The above study was published in *Nature* in 1997 under the title 'Nepotism and Sexism in Peer Review' (Wennerås and Wold, 1997). The paper caused extensive reaction both in the scientific and the popular press. The board of directors of the Swedish MRC was replaced, in part because of the Wold-Wennerås study. The proportion of female evaluators was increased and strict guidelines and monitoring procedures were introduced to reduce injustice in the evaluation procedure. The end result was increased fairness, and hence, quality in the choice of recipients of grants and positions. Another key factor in the MRC's improvement of the peer review system was increased transparency of the evaluation process. Thus, all applicants now routinely receive their evaluation scores and the identity of the peer reviewers is known.

Scrutiny of peer review in the Netherlands

The publication of the Wennerås and Wold (1997) article inspired a similar study in the Netherlands, sponsored by the Dutch Ministry of Arts and Sciences and conducted by the Dutch Association of Women's Studies. The researchers analysed success rates of male and female applicants to the main research granting agencies, the Netherlands Organisation for Scientific Research (NWO) and the Dutch Royal Academy of Arts and Sciences (KNAW). They concluded: 'gender *does* play an independent role in the evaluation of women, regardless of their academic merit' (our emphasis). The evaluation of men, however, was found to be in tandem with their academic status (Brouns, 1999).

The researchers had addressed the question: 'Is it possible to identify any gender differences in the evaluation systems and the awarding of grants by the NWO or the KNAW?' They conducted a survey that focused on the post-doctoral fellowship programme of the KNAW and two programmes

'... the credibility of the academic system will be undermined in the eyes of the public if it does not allow a scientific evaluation of its own scientific evaluation system.'

Wennerås and Wold, 1997, p 341

for individual research grants within the NWO: the Talent-stipendium and the Pioneer-programme. They found that the percentage of women who applied was, in all the programmes, by and large, similar to the percentage of grants awarded to women. However, a detailed comparison of some of the applications was conducted to test the hypothesis that women applicants might have a better track record than men, since they had already survived the gendered selection processes in academia. An in-depth analysis of 138 Talent applications and a selection of files in the years 1993 and 1994 in two disciplines were scrutinised: the exact sciences (E) and the biological, ocean and earth sciences (BOE). The disciplines were selected for being remarkable: in the exact sciences, women's success rate was significantly better than that of men (100%), in the biological, ocean and earth sciences, it was significantly worse (0%).

Table 4.1: Analysis of applications to the Dutch research bodies by gender, 1993 and 1994

Programmes	Male applicants	Male awards	Female applicants	Female awards
Talent total	188	80 43%	35	13 37%
E sciences	81	34 41%	8	8 100%
BOE sciences	36	10 28%	9	0 0%

The analysis, based on multiple regression, revealed interesting tendencies in the relationships between characteristics of applicants (productivity, age and promotion speed), evaluation by external advisers, and decisions of the NWO (however, the numbers prevent statistically significant conclusions). On the level of the whole population, the figures are reassuring: the decision of NWO is in concordance with the external evaluations. However, there is a problem. Statistically the evaluations of the external advisers are unrelated to the characteristics of the applicants and hence the basis for the evaluation is unclear.

It should be noted that of the 270 external advisers (peers) who were involved in the evaluation of the applications, only 4 were women.

When the NWO decisions are analysed with respect to gender, it is remarkable that for men, the decisions correlate with the productivity, age and promotion speed of the applicants. However, with respect to women, this was not the case. Women applicants in the E-sciences were generally evaluated as better than men, but seemed to receive a bonus. Women in the BOE sciences were generally evaluated to be as good as men, but the decisions were negative. In the evaluation of the external advisers of the BOE applications, there appears to be a gender bias as well. Women and men with equal track records receive different evaluations. Men are much more often marked as excellent than women (Brouns, 1999).

Peer review in the UK

The MRC in the UK also analysed application and award rates for their fellowship schemes by gender for the year's 1993/4 to 1996/7. For the clinical fellowships, women comprised 31.9% of applicants but received 33% of the awards. For the clinician scientist fellowships, women were 24.8% of the applicants but obtained 32.5% of the awards. For the non-clinical research fellowship scheme, women were 50.8% of the applicants and got

Correcting discrepancies

In Sweden, the Medical Research Council (MRC) retrospectively investigated their grant-giving policy with respect to gender and seniority of the researcher. Among the scientists given equal competence scores by the MRC peer reviewers, male researchers obtained larger grants than female scientists. Older scientists obtained larger grants than younger scientists. The Swedish MRC has corrected these discrepancies and the size of the grants is now only based on competence scores (Abbot, 1997).

46.2% of the awards. For the non-clinical research fellowship scheme, women were 50.8% of the applicants and received 46.2% of the awards. And finally for the career development awards, women formed 38.6% of the applicants but received only 25% of the awards. The MRC study concluded that there was no general evidence of bias for or against women applicants. In some schemes, women received more awards than expected, in others, fewer. None of the differences were statistically significant ($p < 0.05$).

However the MRC did go on to analyse the career development awards in more detail, since these had shown the largest differences. They looked at publication records and impact factors for the five years prior to application. They concluded successful women and men had similar publication records, while the women and men who were short-listed but unsuccessful published in lower quality journals.

The MRC did state however in their analysis of the data that ‘it is notable that so few female academic staff are applying for funding and it is important that the reasons for this are analysed further’ (Grant, Burden & Breen 1997, with additional information supplied by Gillian Breen).

Postdoctoral fellowships from international organisations analysed by gender

A breakdown of recipients of postdoctoral fellowships awarded by international organisations is shown in Tables 4.2–4.5. Data are presented from the European Molecular Biology Association (EMBO), from the Human Frontiers Science Programme (HFSP), from the TMR Programme in the Fourth Framework Programme and the first round of the Marie Curie individual fellowships in the Fifth Framework. Fellowships from these organisations are usually considered more prestigious than those awarded by national bodies. The work supported must be performed in a foreign country. Indeed, these fellowships are important in supporting the mobility of young scientists around different Member States in Europe, allowing them to develop their contacts, networks and reputations. Some fellowships, for example those from EMBO and from HFSP, allow exchanges between European and non-European countries. EMBO and the HFSP support projects in the life sciences, while the European Commission’s TMR and Marie Curie fellowships are open to all disciplines.

European Molecular Biology Association (EMBO) fellowships

Table 4.2: European Molecular Biology Association (EMBO) Fellowships by gender (1997-98)

Year	Male			Female		
	Evaluated	Selected	Success rate	Evaluated	Selected	Success rate
1997	484	128	26.4%	350	89	25.4%
1998	474	108	22.7%	316	48	15.2%

Source: EMBO

As Table 4.2 shows, in 1997, female applicants had approximately equal chances of getting an EMBO fellowship. In 1998, however the female success rate was only 66% of that of men.

Human Frontier Science Programme (HFSP) fellowships

The HFSP only began to analyse applications for the postdoctoral programme by gender in 1999. Women formed approximately 22–25% of the applicants and received 40/160 or 25% of the awards.

The Training and Mobility of Researchers Programme

In the TMR programme, the female success rate was only 83% of the male rate when all disciplines were combined. The discrepancy between the female and male success rates was greatest for economics and for chemistry (female success rates 72% and 75% of the male rate) and least for life sciences and earth sciences (female success rates 87% and 89%). In none of the six disciplines was the female success rate greater than the male.

Table 4.3: TMR Marie Curie Fellowships Programme (Fourth Framework), applicants by panel and gender

Panel	Male			Female		
	Evaluated	Selected	Success rate	Evaluated	Selected	Success rate
Chemistry	1,059	299	28%	730	153	21%
Earth	523	104	29%	261	68	26%
Economics	1,166	287	25%	919	164	18%
Engineering	950	198	21%	259	45	17%
Life	2,351	550	23%	2,065	413	20%
Mathematics	955	237	25%	240	47	20%
Physics	2,324	523	23%	597	119	20%
Total	9,328	2,198	24%	5,071	1,009	20%

Source: European Commission

The Research Directorate commissioned a study of the involvement of female researchers in the TMR Programme. It is designed to provide information on specific barriers to mobility facing women researchers as well as to look at the experiences of women fellows. The project, directed by Dr Louise Ackers, will be completed late 1999.

Table 4.4: IHP Programme Marie Curie individual fellowship (Fifth Framework) applicants by panel and gender

Panel	Male			Female		
	Evaluated	Recommended for funding	Success rate	Evaluated	Recommended for funding	Success rate
Chemistry	107	46	43.0	64	30	46.9
Economics	64	24	37.5	43	19	44.2
Engineering	37	17	45.9	14	8	57.1
Environment	93	40	43.0	44	16	36.4
Life Sciences	112	45	40.2	135	48	35.6
Mathematics	47	20	42.6	17	8	47.1
Physics	191	81	42.4	63	18	28.6
Total	651	273	41.9	380	147	38.7

Source: European Commission

Only a small number of Marie Curie fellowships have been awarded in the Fifth Framework programme so far. However, the female success rate has increased to 92% of that of males when all disciplines are combined. The female success rate was lower in environment, life sciences and physics, the discrepancy being greatest in physics where women only achieved 67% of the male success rate. However, women outperformed men in four other disciplines: chemistry, economics, engineering and mathematics. The differences were greatest in engineering and in economics where males achieved 80% and 84% respectively of the female success rate. The question remains as to whether these differences will remain constant as more fellowships are awarded.

Research grants in the EU and in Member States analysed by gender

Success in science depends not only on having ideas but also on having the resources to test them. Scientists with larger groups have a competitive advantage over those who have smaller groups. The size of the group is usually related to the number and size of the research grants that can be obtained from national and international sources. It is therefore reasonable to pose three questions relating to gender in this context. First, do women make as many applications as men? Secondly, what share do women obtain of grants from national and international sources? Thirdly, do women and men at comparable levels get grants of the same size?

In the US, there was a survey of the resources allocated to tenured researchers in a division at the National Cancer Institute. Female researchers on average received less than two thirds of the budget and a mere 63% of the research staff given to male researchers of equal seniority (Abbot, 1997; Seachrist, 1994).

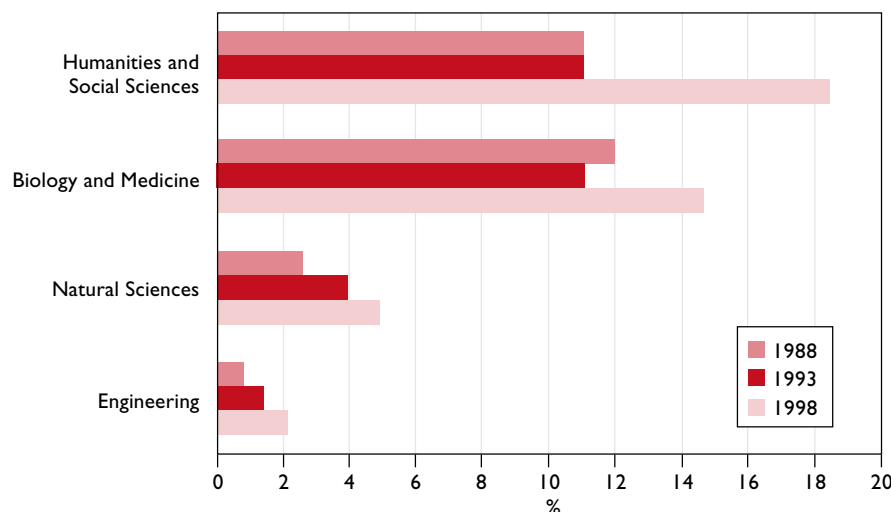
Gender disaggregated data on application rates for grants from research councils in the EU are hard to come by. Figures for Denmark, French-speaking Belgium and Finland however are set out in Appendix VII. Even then they are hard to interpret without knowing the size of the pool from which the applicants come. Do women apply less than men or are there simply fewer of them? Appendix VII shows that in Denmark, women are much less likely to make applications than men but that there are discipline differences. Figures are higher among medical researchers (where 28% of applications come from women) and social scientists (27%) than among natural scientists (12%) and those applying to research technical subjects (7%). The Finnish data shows the higher up the academic hierarchy, the fewer applications come from women. Women make up 44% of applications from post-doc researchers but only 14% from academy professors.

Several studies show that women get a far smaller share of the total resources devoted to research than should be expected from their numbers. For example, only 20% of grants from the British Medical Research Council (MRC) as well as from the Wellcome Trust are given to female researchers. This is despite the fact that they constitute 44% of the academic staff in the biomedical field in the UK (Grant, Burden and Breen, 1997).

In Denmark, in 1996, applications to the research councils and other programmes supporting research were analysed by gender. The overall success rate for women was 36% and for men 49%. This means that the female success rate for applications was only 73% of the male success rate. Again there are great differences between the research councils. Only in 3 out of the 13 organisations did women have a higher success rate than men (Vestergaard and Taarnby, 1998).

In Germany, applications to the major funding agency for the universities, the Deutsche Forschungsgemeinschaft (DFG), were analysed by gender in 1988, and thereafter. Comparison of results for the individual grant programme showed that in 1988 and again in 1993, women were being funded in proportion to the rate at which they applied. That is, the percentage of women among grantees mirrored that among the applicants. The data shown in Figure 4.2 compares the percentage of grants given to women in the years 1988, 1993 and 1997 in the individual grants programme. For biology and medicine as well as for natural sciences the percentage of grants going to women has increased from 12% to 14.6% and from 2.5% to 4.9% respectively between 1988 and 1997. In social sciences during the same period, the percentage of grants going to women increased from 11% to 18.2%. If all programmes of the DFG are taken into account women receive only 10% of the grants that are awarded. The DFG has no information as to whether men and women at comparable career levels are equally likely to apply for research grants, nor has it analysed whether they receive similarly sized grants.

Figure 4.2: Individual grants awarded to women by the DFG in Germany: By year and discipline



Source: Data from DFG

Wellcome Trust Audit

Following the Swedish MRC study, the Wellcome Trust, an independent charity that is the largest non-government source of funding for biomedical research in the UK, audited its decision-making processes on awarding grants. The results were published in a publication entitled *Women and Peer Review* (Wellcome Trust Unit for Policy Research in Science and Medicine,

1997). In this audit, three types of applications were analysed: Project grants for 1996, Programme grants for 1994–1996 and senior research fellowships in basic biomedical science for 1994/95–1996/97.

These programmes were selected for analysis as they are representative of the kind of support offered by the Trust to scientists in the UK. The results of the project grant audit showed that women and men had comparable success rates (male success rate 27.5%, female success rate 26.9%). This is also apparent from Figure 4.3 in which the data are broken down by age. The publication patterns of the male and female applicants were also analysed, and shown to be nearly identical. However, four times as many men as women applied for the project grants. The programme grant audit looked at applications to the Trust that are similar to project grants but which involve larger amounts of money and are given usually for five years. Here, women were more successful than men (62.2% versus 47.8%). The bibliometric analysis showed that the successful male applicants for project grants publish significantly more papers per year than do successful female applicants but that there was no significant difference between men and women when the expected impact factors were compared. However men were five times more likely to apply for Programme grants than were women. The Senior Research Fellowship Programme is for scientists five to ten years after completing their PhDs. It provides not only salary support for the awardee but also provides personnel and supply support. The audit of this scheme shows that female applicants were more successful than male applicants (8.6% versus 5.5%). However, twice as many men as women applied for this programme.

Figure 4.3: Wellcome Trust: Number of rejected and awarded project grant applications by age and sex (1996)

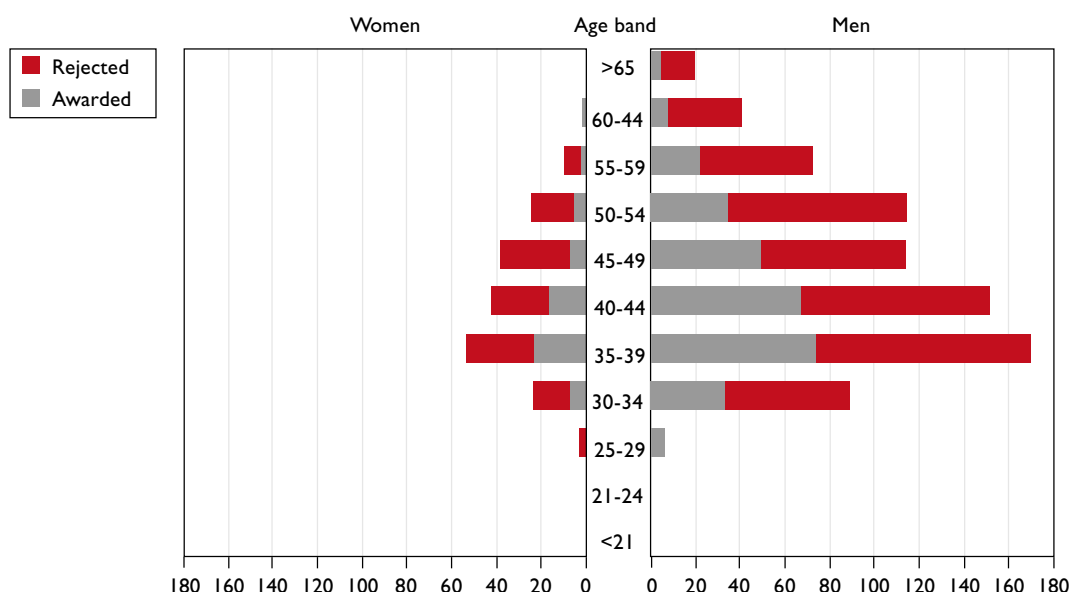


Figure reprinted from Wellcome Trust Unit for Policy Research in Science and Medicine (1997)

The study concludes that for the Wellcome Trust's Programmes, there is no evidence of discrimination against women. Women are appointed in approximately the same proportion as they apply and comparison of the bibliometric data shows that their productivity is approximately equivalent to that of the men.

One striking finding of the study was that women do not apply for Wellcome Trust project and programme grants in the numbers that would be expected from the number of female academics working in biomedical research in the UK.

Funding for young scientists to establish independent groups

Dorothy Hodgkin Fellowships: UK

The Dorothy Hodgkin Fellowship Programme in the UK is not strictly women-only but gives out a message that encourages women to apply and has proved very significant for women scientists. These fellowships offer a salary for four years, an annual research expenses grant, the possibility of holding appointments on a part-time basis or of converting from full-time to part-time and back again to help match work and family commitments. It also provides the possibility of claiming some funds for 'family support' such as the cost of childcare during a conference abroad and offers career advice as well as mentoring and network opportunities. The scheme is described as targeting '...able young people in the first few years after their PhDs. The scheme is open to both sexes and offers the kind of flexibility and support that is advantageous to both, but particularly attractive and beneficial to women.' It is run by the Royal Society and 48 awards were made between 1995 and 1999 (a success rate of 5.5%). Of these, 45 (93%) were given to women. On average, 82% of applications have been from women.

Emmy Noether Programme (DFG, Germany)

Applicants must have a PhD and be under 30. Funds are awarded for a personal salary for two years spent abroad and then for three years including research support in Germany. A fifth of the first 53 awards were given to women.

BioFuture Programme (BMBF, Germany)

Awards include a salary for the recipient plus resources for personnel and running costs, this amounts to approximately 1.5million euros per group for five years. Thirty-two awards were made in 1998 and 1999 (success rate 4.1%). Of these 6 (or 18.8%) have been made to women. Nearly a fifth (16.1%) of applications were from women.

Max Planck Junior Groups (Germany)

These are for five years and cover the successful applicant's own salary, as well as providing support for personnel and supplies. In 1999, 8/34 positions (23.5%) were held by women.

These figures show that there is no shortage of quality applications from young women scientists. In particular the large number of women who apply for the Dorothy Hodgkin Fellowships show that the unusual degree of flexibility these fellowships offer is highly valued.

Determinants of 'academic success'

Peer review focuses on output and productivity as well as excellence. However, the determinants of productivity are complex. A large cohort study of academic paediatricians in the US was conducted to identify which factors determine academic productivity (Kaplan et al, 1996). The authors found that women's academic careers were significantly less brilliant than those of their male colleagues with an equal number of years in the field. Academic success depended on scientific productivity, and women produced fewer scientific papers per year than men. However, when a large number of potential explanatory factors were examined, multiple regression analysis revealed that two factors determined academic productivity and hence, success:

- a high level of financial and practical support from the clinical department; and
- little time spent with patient and teaching duties.

The poor success of woman doctors depended on their lower publication pace, which in turn depended on the fact that they were assigned more basic patient care and teaching of students than their male colleagues.

In this study, there was no relationship between academic productivity and family structure – those women with children did not produce less than their childfree colleagues. Indeed previous studies have shown that married women, as a rule, produce more scientific papers per year than single women – and those with children have equal or higher productivity than those without children (Cole & Zuckerman, 1987; Luukkonen-Gronow and Stolte-Heiskanen, 1983; Kyvik, 1988). Career breaks and childcare are important issues nevertheless and taken up elsewhere in this report.

More research is clearly needed to establish whether there are fundamental differences in the ways in which women and men publish and whether such differences, if they exist, are discipline dependent. One study of biochemists has suggested for instance that women tend to publish more information per paper than men (Long, 1992). They publish fewer papers, but those they do produce are cited more frequently (Sonnert and Holten, 1995a, 1995b, 1996) (see also the Wellcome Trust data discussed above on Senior Research Fellowships). In addition, there is little data to throw light on the question do men and women with similar positions have the same sized groups. It is important to compare men and women of similar ages and experience, and at universities of similar standing. Enough individuals have to be included in the sample so that the results are significant. Long, using data from the US showed not that position depends on productivity but that rather, productivity depends upon position! These findings run parallel to bibliometric results on the relationship between the size of research group or laboratory and productivity (Long, 1978). Finally, information based on European data rather than extrapolation from data collected in the U.S would be helpful, particularly if it would allow comparison between the

UK study of grant application behaviour

'The Wellcome Trust and the UK Research Councils are working together in a consortium to examine grant application behaviour amongst academic staff. Following reports showing that fewer women academics apply for research grants than expected, we asked the National Centre for Social Research to conduct a national survey into grant application behaviour. The Centre is conducting a postal questionnaire of 8,000 researchers at all levels from 50 universities. Both researchers and universities will be randomly selected. The questionnaire will focus on the following four areas:

- How often do men and women apply for grants?
- Do university career structures affect grant-applying behaviour?
- Do women and men share the same workload?
- Do attitudes towards making applications differ between the sexes?

We expect the results of this survey to be extremely valuable in helping to review our own policies and practice. It is likely that they will also be of use to universities in examining their own practices.

The study has received the endorsement of the Committee of Vice-Chancellors and Principals, the Association of University Teachers and the National Association of Teachers in Further and Higher Education. The consortium will report on the results of the survey in April 2000.'

Lawrence Low, Wellcome Trust.

situations in different European countries. In this connection we look forward to the results of the study to examine grant application behaviour in the UK.

Output and productivity are regarded as susceptible to objective measurement. However, it is important to bear in mind other factors such as power relations at work, the impact of networks on creating opportunities and assumptions related to gender in sponsored mobility. Women in the humanities and social sciences in France are reported as being more likely to work in groups than men, and therefore being less able to establish a visible, independent reputation (Collin, 1992). The impact of the domestic division of labour is difficult to calculate but evidence shows clearly that it is not evenly shared by men and women. Men will have more time to invest in their careers. In the Netherlands, more women researchers in science and technology research are reported as remaining single (Stolte-Heiskanen, 1991). For scientists of either sex with children, opportunities to find funding to undertake post-docs abroad or indeed to be mobile more generally may be compromised, and/or be assumed by assessors to be compromised. The notion of a gender contract, with a breadwinner husband and a homemaker wife underpins the design of many fellowships. It can lead to stereotypical assumptions about men and women, to men's advantage and women's detriment, in the networking and discussions, in the allocation of opportunities and recommending that goes on as background noise to the objective peer review system.

The ethics of doing research on one sex only

In many instances, research on one sex only is entirely justified, for example in medical science where a condition such as pregnancy only applies to one sex or in the social sciences where the overt focus of enquiry might specifically and legitimately be on the experiences, behaviour or views of a single sex. However, to undertake research on one sex and apply the results to both is poor science. There are examples of this in medical science (see

On the ethics of medical research performed on men only I

Male volunteers and patients are routinely the objects of study in medical research, which has led to sub-optimal treatment of women, for example those with cardiac disease, and also to sub-optimal drug dosage regimes for women and the elderly, as most pharmacological studies have male volunteers. The Medical Ethics Committee in Göteborg, Sweden, took a decision in 1997 to return research applications in which researchers intended to study only persons of a single sex (usually males), despite the disease in question being of concern to both sexes. The researchers were asked to specify the rationale for the one-sex-only design. In 1999, the Swedish Medical Research Council adopted a policy that one-sex-only designs should in principle not be granted research money.

The decision of the Göteborg Ethics Committee arose after a lay person (a woman) contacted one of the committee members and severely criticised an advertisement in the local newspaper asking for male volunteers for a medical study on alcoholism. 'I don't want my tax money to finance research restricted to only men', she said.

On the ethics of medical research performed on men only II

'American women have been put at risk by medical research practices that fail to include women'

Patricia Schroeder, 1990

On the ethics of medical research performed on men only III

A study of 22,000 physicians began in 1981 that demonstrated a beneficial effect of an aspirin every other day on coronary heart disease. Not a single woman was included in this study.

Science 248,1601. 1990.

boxes). There have also been cases in social science, particularly in economics, where labour market analysis is based only on male participation rates. The decision of the Swedish Medical Research Council not to fund research on single sex projects without an adequate justification is a course of action other funding bodies might like to consider.

Conclusion

There are a number of issues raised in this chapter, which warrant further attention. The peer review system is credited with objectivity and fairness but the Swedish study showed that this it is not always adhered to strictly. The study results were devastating for the research community and led to widespread reforms. However, the rigorous Wennerås and Wold study was only possible because of the right in Sweden to free access to public information and because the system was based upon numerical scores. Research councils in other Member States, especially the Netherlands and Denmark, have conducted their own reviews into the peer review process. It is essential that the whole of the academic community have confidence on the peer review system. Transparency and regular scrutiny and review are essential. Funding bodies are urged to address this issue.

Secondly, statistical monitoring is important. Research councils and other funding bodies should monitor the gender of applicants and awardees on an annual or bi-annual basis. If, as appears to be the case, applications from women are small relative to their numbers in the discipline, steps should be taken to understand why this is so and to remedy it. Positive action measures may be appropriate.

Thirdly, the gender composition of research funding bodies, and indeed editorial boards for journals, is a matter of concern when the proportion of women members can in cases be ridiculously low. The process whereby individuals are appointed to such panels is not always transparent or democratic: rather names emerge from existing members. Panel members tend to reproduce panels in their own likeness. Targets could be set to ensure, as in the Italian public bodies, that a gender balance is achieved. The impact of male networks and the exclusion of women from senior positions in the research councils (discussed in chapter 5) are a cause for serious concern. Widening the social base of the elite determining excellence is an important issue (and is further discussed in chapter 5).

Fourthly, there is a concern about male networks and trusting a 'safe' that is, personally known pair of hands. Applications from well-networked applicants can result in rewarding past performance.

In conclusion, the peer review system is rightly revered as an honest, fair attempt to reward and invest in excellence. However, the system has its flaws. Research funding bodies need to engage with them and address them urgently.

Policy points

- Clear criteria for competition.
- Gender disaggregated statistics on application and success rates to funding councils to be in public domain.
- Investigation of under-representation of women among applicants.
- All funding bodies to have at least 30% members of men and women by 2002 and 40% by 2005.
- Review of mechanisms for selecting board members and referees.
- Open competition and limited terms for members of research councils.
- Scrutiny by research councils of own peer review systems. Research councils to develop EO policies and benchmark for good practice.
- Adherence to strict criteria of peer review.
- Review of gender make-up of committees of award granting bodies.
- Support for dependents of post docs awarded fellowships to conduct research abroad
- Funding for research on one sex only should be refused without adequate justification.

Bias is subtle (at MIT)

'Bias is subtle and largely unconscious. The most lasting correction will come only when the numbers of women in science and engineering have grown significantly. For this to happen it is important that the women who are already in the system become an integral part of it: treated equitably and included in decision-making roles at every level of the institution.

Junior women felt included in and supported by their departments. Their most common concern was the extraordinary difficulty of combining family and work. However, as women progressed through their careers at MIT they became increasingly marginalized and excluded from positions of real power in their departments. An important finding to emerge from the interviews was that the difference in the perception of junior and senior women faculty about the impact of gender on their careers is a difference that repeats itself over generations. Each generation of young women, including those who are currently senior faculty, began by believing that gender discrimination was 'solved' in the previous generation and would not touch them. But gradually their eyes were opened to the realization that the playing field is not level after all, and that they had paid a high price, both personally and professionally, as a result.'

Pardue *et al*, *Nature* web site on debates/women
<http://helix.nature.com/debates/women/>

5 Shaping scientific policy

A critical thirty per cent threshold should be regarded as a minimum share of decision making positions held by women at the national level’.

(UN Commission on the Status of Women 1990 (cited in *Human Development Report*, Oxford: Oxford University Press)

(By the year 2000, there should be) ‘... a 25 per cent representation of women for all public appointments and senior positions in science, engineering and technology including chairmanships’.

(Committee on Women in Science, Engineering and Technology (1994) *The Rising Tide: A Report on Women in Science, Engineering and Technology*, London: HMSO)

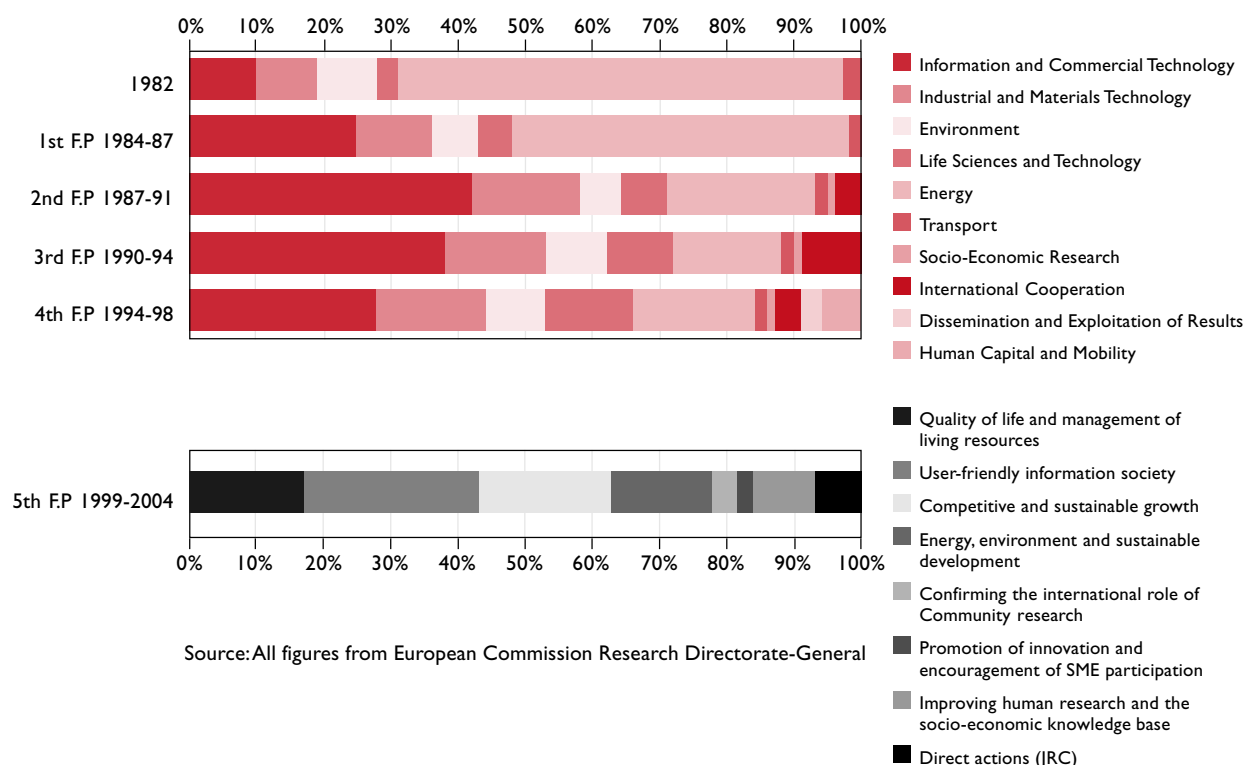
To what extent are women involved in the top decision-making committees that shape the scientific agenda in the EU? Considerable budgets are distributed on a wide range of disciplines and projects and the results of the research supported by the EU can have far reaching implications for everyday life. This chapter looks at the involvement of women in shaping scientific policy and setting the agenda in the top committees of the EU and of the Member States. It asks how well the numbers match up to those called for by UNESCO and by the report commissioned by the UK Government, *The Rising Tide*. It also questions the way science itself addresses the issue of gender in research.

EU framework programmes

At the EU level, science policy decisions are most evident in the measures known as the Framework Programmes. The Framework Programmes encompass specific activities concentrated in particular areas. It is instructive to look at how the money has been distributed between the different areas in the five Framework programmes funded to date. As Figure 5.1 shows, research into energy and particularly into nuclear power dominated spending on research in the early Framework Programmes. The Fifth Framework Programme has been organised in a different fashion and is focused more on problem solving.

‘Half of the brainpower on Earth is in the heads of women. ... Today, the difficulty is to move from the acceptance of equal rights to the reality of equal opportunity. This transition will not be complete until women and men have equal opportunities for occupying position in power structures throughout the world.’

Mr Donald J. Johnston, General Secretary, OECD, at the OECD Conference *Women Entrepreneurs in Small and Medium Sized Enterprises: A Major Force in Innovation and Job Creation*.

Figure 5.1: Changes in RTD Priorities between the different Framework Programmes

The issue of women's representation on committees that decide budgets is a different one from that discussed in Chapters 2 and 3 which focused on women in scientific professions. The question here is whether women, as over half the population, should have an equal say in the allocation of budgets and the focus of scientific endeavour. A case could certainly be made for 50% representation. Would the distribution of resources outlined in Figure 5.1 have looked different with more women on the committees? This is a question to which we return. The following sections examine the gender balance in the key top scientific committees in the EU and emphasise the recent changes in gender composition of many of these committees.

EU level

'There are too few women involved in defining quality'
(Ministry of Research and Information Technology (1997) *Women and Excellence in Research* Copenhagen: Ministry of Research and Information Technology)

Science policy at the EU level is determined by several bodies. These include the European Parliament, the Council of Ministers, and the Commission together with the Committees that advise them. Input at the political level for the Framework Programmes comes from the European Parliament and in particular from the Committee on Industry, External Trade, Research and Energy and from the Council of Ministers of the Member States who together determine the form the Framework Programmes will take.

Women are relatively well represented in the European Parliament compared with most Member State Parliaments. After the 1999 elections, 30% of the MEPs were female. The representation of women among MEPs varies from a low of 10% in Italy to a high of 50% in Sweden. In 1999, a third of the members of the Committee for Industry, External Trade, Research and Energy are women (19/60 or 32%).

Among the Council of Ministers, there are relatively few women (4 out of 15). However some male Ministers have spoken out strongly in support of increasing the representation of women in science.

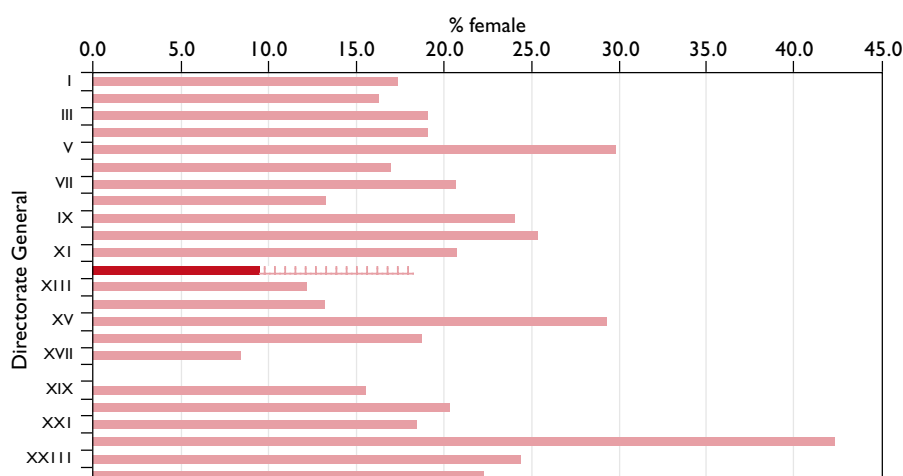
In the case of the Commission, input is provided by the Commissioners, their cabinets and by members of the commission staff working in the different Directorates. It is therefore relevant to ask what input women have had into policy formulation at these levels. From 1995 to 1999, 5 out of the 20 Commissioners were female; a significant increase compared with previous Commissions. A new Commission was confirmed in the autumn of 1999. Five of the new 19 Commissioners (26%) are female. Philippe Busquin, the new Research Commissioner, has expressed his strong commitment to gender equality in science. Each Commissioner has a cabinet. Almost 40% of Cabinet appointments (45 out of 120) are women. In five cabinets either the Head or Deputy Head is female. Every cabinet has at least one woman.

Figures are also available for the percentage of posts in each Directorate General (DG) that are filled by women. We have chosen to use the percentage of 'A'-grade posts (professionals) occupied by women in the different DGs as a measure of the influence of women within the Commission. Figure 5.2 shows the percentages for each DG, with that for the Research Directorate-General highlighted in red. Only 9.5% of the official posts in DGXII in the A grades are occupied by women. However, if 'temporary research staff' are also included, the percentage of women in the Research Directorate-General increases to 18.7%. A breakdown of individuals in A-grades into categories A1 to A8, with A1 being the top category, is informative. Figure 5.3 gives the overall distribution of women in grades A1-A8 for all DGs, together with the breakdown for DGXII. It shows that there is no woman among the 14 individuals in the grades A1 and A2, and only 1/40 in the A3 grade. These numbers for the distribution of women in A-grades are reminiscent of the vertical segregation of women in academia described in Table 2.1. The situation is similar to that in the early 1990s: the conclusion has to be therefore that so far, women among the staff of the DGXII have had a minor role in the formulation of scientific policy.

Members of European Parliament, 1999

Member State	% women
Austria	38.1
Belgium	28.0
Denmark	37.5
Finland	43.8
France	40.2
Germany	36.4
Greece	16.0
Ireland	33.3
Italy	10.3
Luxembourg	33.3
Netherlands	32.3
Portugal	20.0
Spain	34.4
Sweden	50.0
UK	24.1

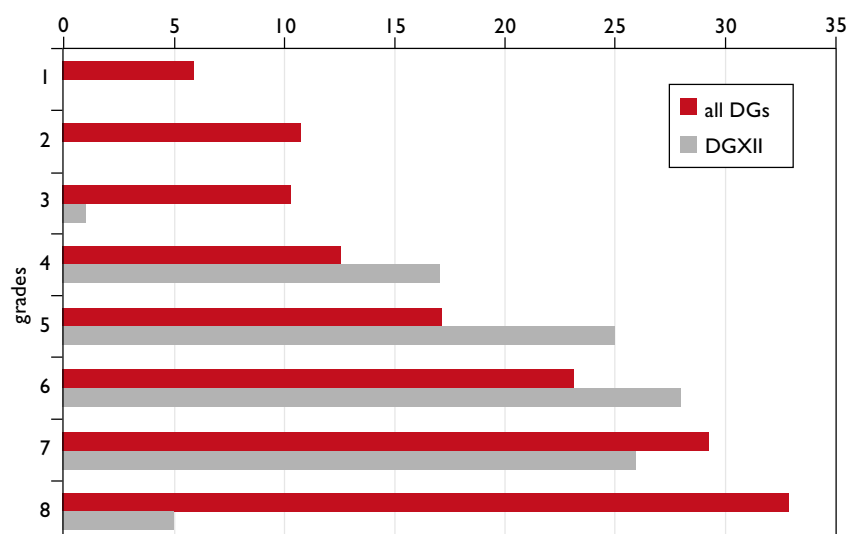
Figure 5.2: Percentage of women in A grades in the Directorate Generals of the European Commission



Note: Officials are shown by solid bars. The checked bar for DGXII indicates temporary research staff.

Source: Figures provided by the European Commission (DGIX).

Figure 5.3: Percentage of women in Grades A1 - A8 in the European Commission: The Research Directorate-General compared with all Directorates (1999)



Note: The numbers for DGXII include officials and temporary research staff.
Source: Figures provided by the European Commission (DGIX)

Input from scientists to the Framework Programmes can come via EU committees or through committees in the individual Member States. Here it is relevant to look at the gender composition of the major committees that set policy and control funds at the EU level. An enormous change has taken place recently in the gender composition of these committees. This started during the Fourth Framework Programme and has accelerated during the first year of the Fifth Framework Programme.

We illustrate this by focusing on the top EU committees which set policy in the Fourth and Fifth Framework Programmes. In 1993, those were the Industrial Research and Development Advisory Committee (IRDAC), the Committee for the Development of Science and Technology (CODEST) and the Scientific and Technical Research Committee (CREST). In 1993, only 1 of the combined 75 members of IRDAC, CODEST and CREST was female.



'That's an excellent suggestion, Miss Triggs. Perhaps one of the men here would like to make it.'

In 1998, IRDAC still had no female member. Of its 24 members, 19 were senior industrialists and 5 represented European organisations. IRDAC was the main advisory board of the EC concerned with industrial research and development. It advised the Commission on 'strategic issues concerning the shaping and implementation of Community policy in the field of research and technological development including the industrial and social impact thereof'.

The formation of ESTA - *the European Science and Technology Assembly* – was announced in 1994. Its function was to assist the Commission with the implementation of EU

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research and development policy. The 27 members of CODEST automatically became members of ESTA; the other 73 slots were filled by asking the European organisations (listed in Table 5.1) to nominate individuals. Organisations were asked to nominate approximately twice as many individuals as there were places, with the final selection of ESTA members being made in Brussels. This was to give the European Commission a chance to balance ESTA according to the criteria set out in the Decision, that is, geography, different types of research (pure, applied and development) and the various fields of scientific and technological activity. In 1994, only 4 out of the 100 members were female.

Table 5.1: Composition of ESTA in 1994

Members proposed by:	Number of members	Number of women
CODEST	27	1
European Science Foundation (ESF)	12	0
European Industrial Research Managers' Association (EIRMA)	12	0
Academia Europaea	6	2
All European Academies (ALLEA)	6	0
European Rectors' Conference (CRE)	6	0
European Council of Applied Science & Engineering (EURO-CASE)	4	0
Industrial Research & Development Advisory Committee (IRDAC)	4	0
UNICE	2	0
European Round Table (ERT)	2	0
European Round Table Confederation (ETUC)	2	0
CERN	1	0
European Space Agency (ESA)	1	0
European Southern Observatory (ESO)	1	0
European Synchrotron Radiation Facility (ESRF)	1	0
Direct Appointment by European Commission	13	1
Total	100	4

Source: EU Commission. See also *Nature*, no 372, p 720

Note: The breakdown by country is as follows (female/total): Germany 0/16, France 0/14, UK 0/11, Italy 0/10, Spain 2/7, Netherlands 0/7, Belgium 0/7, Ireland 1/5, Denmark 1/4, Sweden 0/4, Switzerland 0/4, Austria 0/3, Finland 0/2, Portugal 0/2, Greece 0/1, Norway 0/1, Iceland 0/1 and Luxembourg 0/1. ESTA members are listed by country where they work rather than by nationality.

Edith Cresson, when asked about the composition of the 1994 ESTA in a question in the European Parliament, stated that women are relatively under-represented in many of the European organisations that were approached to nominate individuals. Indeed, the lists put forward by these organisations often failed to include a single woman. Nevertheless, she said that the Commission had endeavoured to choose as many women as possible and would pursue the same line when the membership of the Assembly was renewed in 1997. In that year, ESTA was reduced in size to 61 members but the representation of experts in the social and economic fields was increased. In the 1997 ESTA, women held 5/61 or 8% of the seats.

ESTA

In 1997, women held 5/61 or 8% of the seats. The breakdown by country is as follows (female/total): EU Countries: Germany 0/9, U.K. 0/9, France 0/7, Italy 0/6, Spain 1/4, Netherlands 0/4, Sweden 0/3; Belgium 0/3, Austria 1/2, Denmark 1/2, Ireland 1/2, Finland 0/2, Luxembourg 0/1, Portugal 1/2; Other Countries: Iceland 0/1, Israel 0/1, Norway 0/1, Switzerland 0/2.

CREST

In 1998, women held 16 of the 45 seats. The breakdown by country is (female/total): EU Countries: Austria 0/2, Belgium 2/4, Denmark 0/2, Finland 1/2, France 1/4, Germany 0/3, Greece 0/2, Ireland 2/3, Italy 0/2, Luxembourg 1/3, Netherlands 1/3, Portugal 2/3, Sweden 3/3, Spain 1/2, UK 1/2. EFTA Countries: Iceland 0/2, Lichtenstein 0/2, Norway 1/2.

CREST shows a dramatic improvement in gender balance change in comparison to 1993. Then, CREST had no female member at all, whereas in 1998, this committee (where delegates are chosen by the Member States) had 16/45, or 35% female members.

The Research Directorate-General announced in 1998 that it is to restructure its two advisory bodies –IRDAC and ESTA – into a two-chamber body to be known as the European Research Forum, bringing together industry and the academic community. However the composition of this new body has not been made public to date.

Advisory groups and assessment panels in the Fourth and Fifth Framework Programmes:

The Assessment Panels for the Fourth Framework. Information on the gender composition of the assessment panels, and of the awardees, was not collected systematically. The TMR and the TESR Programmes did however collect an analyse such information. In 1995, between 11 and 23% of panel members were female compared with between 15 and 28% in 1997. In the two selection panels determining access to large-scale facilities (activity 2), the ratio of women to total members was 1/31 (3%) and 1/7 (14%). In the seven panels responsible for choosing postgraduate and postdoctoral grants for training, grants for experienced scientists and return grants (activity 3) which are discipline specific, women formed 13 to 24% of the panel members. In the selection process for accompanying measures (Euroconferences, summer courses and practical courses), women were 7% of the primary reviewers and formed 20% of the panels that reviewed these proposals in Brussels.

Assessment panels for the Targeted Socio-Economic Research Programme (TSER). This programme was concerned with the evaluation of scientific and technical policies, research on education, and research on social exclusion and integration in Europe. 45/184 (25%) of the members of the review panels was female.

Framework Programme Monitoring Panel. The Panel for the Fourth Framework had no women members: currently, three of the eight members of the Fifth Framework Monitoring Panel are women (1999).

Advisory groups and assessment panels for the Fifth Framework Programme.

Information on the gender composition of panels and awardees will be systematically collected in the Fifth Framework Programme. This dramatic change is in part attributable to the inclusion of gender among the selection criteria for panel members. The call for individuals to serve on the advisory groups for the Fifth Framework Programme in the *Official Journal of the European Communities* on 13.6.98 included the following passage:

... the Commission will adopt the list of members of advisory groups which will subsequently be made public. It will endeavour to ensure that the groups have a balanced composition. To this end, it will take account of the geographical origin and sector of origin (industry and services, research and innovation, users and public regulatory bodies, and socio-economic circles) of the applicants in question. *The Commission will also endeavour to ensure a balanced participation between women and men.* (our emphasis)

'By building methods for doing science in a more interactive and exclusive way, we can make active partners of all the parties involved and ensure the full participation of women and young scientists ... wider participation opens new prospects, affecting how research is done and its focus.'

Federico Mayor, Director-General of the United Nations Educational Scientific and Cultural Organisation (1999) *Science* no 285, p 529.

Individuals were encouraged to apply for the Expert Advisory Groups with the final choice of membership being made by the Commission in consultation with the Member States. 80/303 (26%) of members of the 17 advisory groups are female. 7/17 of the groups are chaired by women. Individuals were required to apply to be considered for the assessment panels charged with evaluating proposals for the Fifth Framework. The aim of the Commission is to see that women form 40% of the members. Exact statistics are not yet available but it is clear that women are well represented on these panels.

In summary the Commission has begun to make significant strides towards including women on its science and technology committees both in terms of percentages and absolute numbers. More women now have the chance to gain experience at EU level.

Member States

It is important to look at numbers for the EU and elsewhere in relation to those for committees within the Member States and in other European countries. Some Scandinavian countries require national committees and equivalent bodies, including the National Research Councils, to have a minimum of 40% of each gender (see for instance the amendment to the *Gender Equality Act* in Finland, 1995). In the UK, in 1998, the Committee for Science and Technology had 4/15 (27%) female members, while 17/98 (17%) positions on individual Research Councils were occupied by women. For the individual Research Councils, the proportion ranges from 6.3% to 28.6%. Alternatively EASO, a committee of senior officials with policy responsibility for science and technology, has only 1 female out of 14 members (7%). In 1998, 10/71 (or 14.1%) members of the Swiss National Science Council were female, including its President. In Germany, in 1998, 6/38 (16%) of the members of the DFG Senate are female. Ten of the 16 German States have female Ministers responsible for education and science. The Federal Minister for Science and Education is also a woman.

However many top scientific committees in Germany, and in other countries such as Italy, have much lower numbers of women. For instance, in 1994, the President, the President's Board (15 members) and the President's Scientific Board (11 members) of the Italian Research Council (CNR) were all men, even though 30% of CNR's researchers are female. In 1999, only one out of eight members of the Presidency Council was a woman and the 24 members of the Scientific Board were all male. Numbers for important committees in other countries have been given and discussed in the previous chapter on funding and in Appendix VIII.

This review of the position of women on important scientific committees shows that while some Member States have made significant progress in increasing their participation (eg Finland and the UK), others lag behind. Boards running charitable institutions in the private sector seem often to have fewer women than those in the public sector. It is particularly striking that several private charities that provide large amounts of money for medical or cancer research have no women on their boards of trustees (e.g. the Wellcome Trust has 0/10), or on their current scientific advisory board (eg Imperial Cancer Research Fund 0/10) or their medical advisory board (eg the Mildred Scheel Foundation of the Deutsche Krebshilfe 0/10).

French scientific education and elite formation

In order to achieve a gender balance in senior decision-making, it is necessary that boys and girls follow the same type of education and training. In France, most people in top positions are members of the alumni of the *Grandes Ecoles* (High Schools). *Grandes Ecoles* specialise in administration, science, or management. Entry is through a very selective entrance examination. In French society, the situation of *Grandes Ecoles* has achieved a somewhat mythical status: many families dream of having a son entering *Ecole Polytechnique* or *Ecole Nationale d'Administration*, but up until now, very few entertain such hopes for their daughters. The *Ecoles*, besides providing privileged conditions for study, offer students a very useful entree into the 'old boys network' for the rest of their career.

Claudine Hermann

The increase in the number of women on boards that set policy at the EU level is a powerful spur to Member States to increase the representation of women on important committees at national level in those Member States where they currently are poorly represented. The EU Parliament, as well as the Commission and the Member States should make sure that this is done. As a recent article in *Nature*, stated, 'If the Commission is intent on encouraging women in science it should also seek to stimulate new standards in the national programmes of EU Member States' (*Nature* vol 400, p 195).

The European Science Foundation

The ESF acts as a catalyst for the development of science by bringing together leading scientists and funding agencies to debate, plan and implement pan European initiatives.

None of the seven members of the ESF Board in 1999 are female. There are just two women on the executive council whose 27 members are all nominated by individual countries. The composition of the committees is given in Appendix VIII.

Table 5.2: Women Members of the European Science Foundation (1997-98)

	1997		1998	
	F/Total	% F	F/Total	% F
Statutory Meetings*	15/108	13.8	11/98	11.2
Associated Committees**	5/123	4.1	4/118	3.4
Standing Committees***	15/148	10.1	14/124	11.3

Source: ESF

* Executive Committee, Finance Committee, Electoral Commission, Network Committee, EURESCO Committee

**CRAF, NuPECC, ESSC, EMaPS and its review Panel

***Members nominated by ESF Member Organisations

For abbreviations, see page 115.

The involvement of women in ESF activities is described in the next table. The first column shows the number of women involved out of the total number. The second shows the number of activities in which these women are involved out of the total number of activities of that committee. On the left are numbers for 1997, on the right numbers for 1998.

Table 5.3: Women' Involvement in the European Science Foundation Activities (1997-98)

Activities	1997			1998		
	F/Total	F/activities	% F	F/Total	F/ activities	% F
PESC	9/200	8/20	4.5	9/173	7/15	5.2
LESC	37/327	11/22	11.3	33/304	16/24	10.9
SCH	23/161	9/11	14.3	22/110	7/9	20.0
SCSS	25/148	4/12	16.9	12/157	6/11	7.6
EMRC	3/60	2/3	5.0	12/72	4/5	16.7
EURESCO	N/A	N/A	N/A	1,410/4,781	N/A	29.5

Note: N/A = not available, for other abbreviations see page 115.

Source: ESF

Looking at the numbers, it is clear that women are not well represented on the top ESF Boards. The highest participation of women is in EURESCO conferences.

US and Canada

The proportion of women on the EU's top scientific committees can be compared to those for committees with similar responsibilities in the US or Canada. For instance, in 1994 the President's Committee of Advisers on Science and Technology in the US had 6 women out of 19 members (32%). In 1998, the National Science Board had 8 women out of 24 (33%). The National Science Foundation (NSF) Directorate for Biological Sciences Advisory Committee (BIOAC) had 7 women out of 15 members (47%), while on the NSF Biological Sciences Advisory Panels, 234 of the 696 panellists are female (34%). In 1998 the Council of the National Sciences and Engineering Research Council in Canada (NSERC) had 8/21 (38%) female members.

Conclusion

The key figures in science in Europe are drawn from an extremely narrow social base in terms of age, gender and ethnic origin. White men over 50 overwhelmingly dominate senior scientific committees that award research funds, grants and prizes. Recipients tend to be in the same demographic category. This will inevitably affect the shaping of the scientific agenda. The exclusion of women from top decision-making positions in science is of particular concern.

The lack of women in key decision-making positions is not just a matter of equity and gender balance however. It may affect what areas of research are invested in. It may affect the extent to which the gender dimension is treated seriously in research itself. The spin-off from male dominated science is far reaching, and self-perpetuating, feeding back into media images, education and pedagogy. This is the focus of Chapter 6.

Policy points

- **Fairer gender balance in important scientific committees that set policy.**
- **Examination of criteria and mechanisms for joining elite scientific bodies.**
- **Framework Programme Monitoring Panels should include gender mainstreaming in their monitoring activities.**
- **Increase women in A1-A3 (top grades) in the Research Directorate-General (in line with other Directorates).**
- **Calls from the European Commission to Member States for nominees for important committees should contain a request to ensure a reasonable number of women are included.**

6 Educating scientists, destereotyping science

‘I’d like to be a vet but I expect I’ll be a mother’
(8 year old girl)

To ensure that public money invested in training women to become scientists is not wasted by mechanisms that exclude them from developing their careers, some long-term strategies are needed to remove indirect forms of discrimination. These strategies will also help to ensure that we do not continue to lose scientists irrevocably as a result of career breaks. The question has to be posed, if universities, research institutes and other employers of scientists are not prepared to address the issue of retaining and attracting women back into science, is there any point in educating them to become scientists in the first place? Why not just ban them? Similarly, we educate many boys in science who are not suited to it and drop out, representing a considerable waste of resource. We need to ensure the education system produces, retains and attracts back people suited to scientific careers, be they men or women.

This chapter looks at the position of women studying science, technology and engineering in schools and higher education. Girls have been doing much better at school generally than in the past and more are moving into science subjects but few persevere with science careers. There are country and subject differences. We are concerned with matters of curriculum and pedagogy, and the gendered dimension of the experience of learning about science. What are the exclusionary mechanisms that inhibit women from choosing science subjects? What initiatives have there been to attract women into, or back to science and how successful have they been? What refresher courses or updating schemes are there for women who take career breaks – or are they lost to science forever? Could careers guidance help? What about the stereotypical images of science as a male domain: how could these be challenged? Experiences from the Member States show us that initiatives and projects designed to tackle these issues, while useful in making it easier for determined young women to pursue science, and determined older women to return to science, are like a drop in the ocean. Far more strategic long-term approaches, and serious investment in resources, thinking and innovative ways of organising educational institutions are necessary to ensure potential scientists are not lost because of their sex.

“‘Oh, I thought you were a man” was the astonished exclamation of the famous physicist Ernest Rutherford when he first met Lise Meitner (1878-1969), the woman who played a major role in the discovery of nuclear fission.’

Goncalves, R. (1999) ‘Attracting Women to Science’ *Ecite Bulletin*, no 39, p 10 (European collaborative for Science, Industry and Technology Exhibitions).

'When you are an astronaut, people don't care whether you are a man or a woman'

Carolyn L. Huntoon, NASA.

Women in education

Women have been increasing their level of participation in higher education across the EU and now constitute about half the student population. There are large differences between the sciences of course. While it is easier to find statistics on women in education than in employment in the sciences, the categories used are sometimes problematic. For example, the inclusion of nursing, a highly feminised profession, in 'medical sciences' may in part explain why of all the sciences, women are more likely to be found among students of medical sciences than other branches. Indeed, in Finland, women constitute 84% of medical students in higher education: comparable figures for Denmark are 80% and for the UK, 77%. Women are under-represented in mathematics and computer science and in 'engineering and architecture' in all Member States. Engineering is a particular cause for concern. There are, however, relatively more women on these courses in Spain, Italy and Portugal than elsewhere (all figures from EC 1999: Annex 2; original source Eurostat) (see also Figure 2.2). As Anne-Marie Bruyas from the Fondazione IDIS in Naples observes 'According to the EUROSTAT data, (girls) are well represented in biological and medical sciences (50-70%), but they are under-represented in Mathematics and computer sciences, Engineering. Girls it seems prefer sciences linked to nature, human and social matters' (1999: 10).

The National Curriculum reduces sex segregation in the UK

'Up to the early 1980s boys and girls occupied almost completely different educational tracks. By 1994 most of these differences had reduced, although substantial gender differences still remained in subjects such as physics, craft, design and technology (CDT), economics, home economics and social studies ... On the whole the picture was one of reduced sex segregation of subject choice up to the age of 16.'

(Arnot et al, 1999, p 20).

Educating girls

At school level, there is currently widespread concern with the under-achievement of boys, the low aspirations of girls, and gender stereotyping of subjects and careers choices more generally. The goal must be to enable boys and girls to choose and do well in subjects of their choice, unimpeded by stereotypes. Making core subjects compulsory until the early teen years can help to break down prejudices and ensure that girls remain in science classes longer than they might if allowed to opt out earlier. One of the beneficial effects of the introduction of the National Curriculum in the UK is that girls do science for longer (Arnot et al, 1999).

This still does not mean that they will necessarily choose science subjects when given the choice. There are important pedagogic issues to be addressed, such as evidence that suggests girls are more interested in problem oriented approaches. Teachers might be encouraged to foster better links with industry and the public service where appropriate in order to help them bring practical applications into their teaching. Some literature suggests that in engaging with computers, boys will want to 'master' the machine, whereas girls will want to 'understand' it. Awareness of a range of learning styles, and especially gender tendencies may open up new pedagogic approaches that might appeal better to girls. The siting of computing, as a subject, in maths departments in most European countries has been deleterious for girls, given maths is one area that has traditionally failed to attract girls. Locating computers in language departments, which would be just as logical, would certainly have exposed more girls to them (Pelgrum and Plomb, 1991). Role models are important to young people choosing subjects at school and here, the relative lack of women as heads of science departments in schools is problematic. Indeed, there are more women head teachers in Europe than there are heads of maths departments in schools: this is problematic both for maths and of course for computing (Pelgrum and Plomb, 1991). In all of this, there is a danger of stereotyping

of both boys and girls. The important point to note is that current systems and pedagogies have a gender effect. These need to be tackled for the benefit of both boys and girls.

Research literature on girls' subject and career choices in the UK illustrate, first of all, that many disadvantaged young women do not perceive that they have a choice to make. The strength of the gender contract and sex segregation in post compulsory education and training and in the labour market itself offers 'bounded' choices (Holland, 1988; Rees, 1992). Boys of course are also affected by these factors, leading some to choose science subjects when they are ill suited to them. Moreover, girls and boys make subject choices at a time when their personal development and the construction of their sexual identity are at a highly sensitive stage: to opt for a gender inappropriate course can threaten that identity.

Be a bloody train driver



© Jacky Fleming, from *Be a bloody train driver*, Penguin, 1991

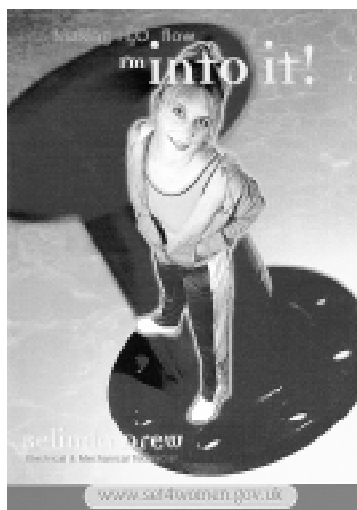
The literature on the relative merits of single sex as opposed to co-educational education for girls choosing science is mixed and confused. All too often, the issue is conflated with other factors such as class. In the UK, for example, single sex girls' grammar schools were reasonably successful in generating scientists. By contrast, many all girl schools in Ireland have not been adequately equipped to teach science. Most schools in the EU now are co-educational and some experiments have been conducted on the impact of this, for example the Eureka project in Luxembourg. There is a general consensus that in terms of academic achievement, co-education is good for boys but not so good for girls: this is notwithstanding the fact that girls have caught up with and now are beginning to outperform boys! Some schools have experimented with single sex computing clubs for girls: they have proved successful in enabling girls to receive more attention and to learn in their own style. Boys do dominate classrooms and demand more attention: there is plenty of research evidence on the inequitable allocation of teachers' time to boys and girls that demonstrates this. This may reinforce gender stereotypical subject choices.

There is work to be done, then, in stripping science subjects of their gendered identity and finding methods, through the curriculum, and through new approaches to pedagogy, to make science more attractive to girls. This is not the well-beaten track of trying to get girls to see the error of their ways in eschewing science and engineering. Rather, it is asking

Mobile classrooms

The "BioTech Mobil", sponsored by the State of Bavaria and the Federal Ministry for Education and Research in Germany, is a mobile classroom used to provide state of the art information about bio and gene technology to schoolchildren, teachers, parents and other interested individuals. The mobile classroom provides hands on experience and is outfitted with the latest equipment with which up to 12 different key methods and experiments can be performed. In a 40 week period in 1997 and 1998 more than 11,000 schoolchildren and 28,000 other individuals visited the BioTech Mobil in 128 different locations.

<http://www.biotechmobil.de>



One of the role models from the 'Go for it' poster campaign produced by Promoting SET for Women, Department of Trade and Industry, UK.

Site visits designed to improve the climate for women in physics

In the US in the 1990s, physics departments arranged site visits to increase the participation of women in physics. The visits, undertaken by five well-established female physicists, take place only upon the request of the department concerned. Factors identified as important for creating a favourable climate for women included:

- the commitment of the department chair and key faculty to the success of the female students.
- presence of more than one senior woman physics faculty member.
- effective communication between students and faculty.
- the availability of day care and a safe environment.

The initial series consisted of 15 site visits, funded in part by NSF.

(Dresselhaus M.S., Franz J.R. & Clark B.R. (1994) *Science* 263, 1392-1393). For details of the current programme see <http://www.aps.org/educ/cswp/sitevisit/htm>

those who set the syllabus, teach and examine science subjects and those who train teachers to meet girls half way. Highlighting equality issues in teacher training should lead to some reflection on teaching practice.

Our concern in this section is with girls' rejection of science subjects at a relatively young age but the obverse of this coin is boys who choose science inappropriately and later find that it is not for them. This, combined with the under-achievement of boys more generally reinforces the need for urgent attention to be paid to the issue of science and gender at school level.

Stereotyping science and scientists

Teachers are not 'to be blamed' or to be blamed alone for girls' rejecting science. The sex stereotyping of science is complex and deep-rooted. There are a number of actors that can play a part in tackling this. Careers guidance staff have an opportunity to challenge stereotypes in subject and occupational choices but the attention paid to gender equality in guidance work is variable (Rees, 1992). Posters, such as the one illustrated from the UK, can be helpful in presenting new images of disciplines and professions including scientific ones. However, for every innovative image presented to young people, there are ten more conservative ones.

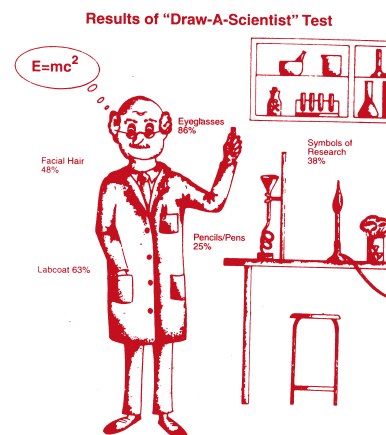
Parents can act as a conservative force when young people choose subjects to study untypical of their gender. They have been found to be more willing to buy a home computer for their sons than for their daughters. The (male) designers of computer games appeal to stereotypical boys' (men's?) fantasies by developing games that are focused around male sport, speed, and zapping aliens. There are many boys too of course that may be put off by this. One of the very few Playstation games recently brought out is aimed at girls (Girland) but rather disappointingly, it is a virtual boyfriend game that lets girls design their own partners. Catalogues for computer games and for toys reproduce traditional images indicating who should play with what and what roles should exist between the sexes. Museums of science and technology have an opportunity to challenge some of these stereotypes in their presentations and interactive exhibits. Bicknell, from the National Railway Museum in York (UK) says this does not necessarily mean painting exhibits pink or filling exhibitions with flowers. It can mean designing exhibitions with multiple entry points on the principle that different people are stimulated by different things (approaches, ideas, subject areas) (cited in Bruyas, 1999). This is redolent of the innovative approach taken at the Teknikens Hus museum in Luleå in Sweden, where the design of exhibitions has been informed by research on how girls and boys differ in their approach to science. Images of science and scientists in museums (and in the media) can be made to be more relevant and affirming for women.

Conventional images of science and scientists held by young people certainly need to be challenged. As Schiebinger reports from the US:

In 1957, at about the same time Barbie was being designed... the anthropologist Margaret Mead and her colleague Rhoda Métraux ... found that the average American high school student expected a scientist to be "a man who wears a white coat and works in a laboratory. He is elderly or middle aged and wears glasses...he may wear a beard.. He may be unshaven and unkempt. He may be stooped and tired. He is surrounded by equipment: test tubes, Bunsen burners, flasks and bottles, a jungle gym of brown glass tubes and weird machines with dials." (Schiebinger, 1999, p 72)

The same children reported to Mead that a scientist ‘... neglects his family – pays no attention to his wife, never plays with his children’ (quoted in Schiebinger, 1999, p 72). Later images constructed in the US in the 1980s suggest little change. These images remain dominant and need to be challenged. A special effort is being made to tackle this in some pilot projects in the EU. For example, the French Academy of Sciences is involved in a project (inspired by the Chicago ‘hands in’ one) that is intended to awaken children’s interest in schooling through the practice of experimental sciences: ‘*la main à la pâte*’. Volunteer teachers are working on the project in a thousand elementary classes in socially under-privileged suburbs.

There is work to be done in building up journalists’ knowledge of women scientists so that they receive more exposure on the media to counteract stereotypical images of scientists. Women scientists themselves and their networks could be pro-active here. Equally, the European communication website (alphagalileo.org), which is designed to bridge the gap between scientific journalists and scientists, should include an equal number of women scientists’ names in its database.



Cartoon of typical male scientist drawn by children: Schiebinger (1999, p 74; original source Kahle 1987).

‘Role models, society and expectations’

‘The solution to getting more women into “non-traditional” fields is unfortunately a more subtle and challenging area than any single institute or group may be able to tackle. It is due to social expectations, and begins from the day a baby girl or a baby boy is born into a family. I do not consider my parents archaic but in retrospect it is surprising that they put so much hope into only one child - the boy - and didn’t expect anything much out of their two girls.

Society brings up children by subtly conditioning them to a way of thinking, and establishing in them life expectations. As a child no one asked me what I thought, or showed me things. For example: “see how that bridge can stand with such a large span?”, “you should spend the holidays with your uncle the computer scientist”, “tell me what you learnt today”, “what type of car is that?”, “why do you think the water is green here but blue over there?”. It wasn’t until I started bringing home fancy report cards, that it was noticed that I might have a “career option”. But it’s not just the parents. Often a teacher can have a profound impact on a child’s life, and their personal views on the place of males and females in society would obviously pervade their approach to educating students on life, whether they realised it or not.

One of the biggest socialisers is television. Role model? What was that? On any television show, the females young and old were praised for having tame ambitions, and encouraged to go out and seek a male provider. Unfortunately things have not changed at all. Certainly, there are more shows aimed at women, but any professional female character is limited to a career in medicine, law, television, fashion or tourism (in all of which women have a good representation in real life). Will someone please explain to me what the problem is with having one or two token female scientist/engineer roles in a sitcom? If we - parents, siblings, friends, teachers, television, magazines, community groups, politicians, society - reward pretty slim girls, with smart one liners and a trail of boyfriends, with praise and admiration, why on earth would a girl want to be anything else?

The focus should be on primary schools - develop the confidence in little girls, to question the wonderful thing that life is, and ask, “Why does that happen?” Or, if you want a controversial answer, pay David E. Kelly to write you a television series with role models in the areas of science, engineering, and trades, (but please get rid of the Ally MacBeals). Look what LA Law did for lawyers, and what ER did for medicine. Unconventional for academia, but extremely effective.’

Lisa O’Connor (from *Nature* web site) Kalgoorlie, Australia
<http://helix.nature.com/debates/women/>

Grimy, Squishy and Slimy – ‘support girls at an early age’

The discussion on the hurdles facing women in graduate studies and the working world, while balancing the social demands of womanhood are interesting. As a practising civil engineer and mother of four I struggle with them myself, however the problem begins earlier.

We need to do more to encourage girls’ curiosity and mechanical skills. They can’t be discouraged to explore things that are grimy, squishy or slimy. These later become fields of mechanics, chemistry and biology. We must do more to keep our daughters fascinated with exploring how our world works. We also need to prepare them for the realities of the adult world. I’ve seen many young, female engineers discouraged by the rudeness of their male counterparts — of course it wouldn’t hurt to teach our sons to be polite — and by the blatant impact of funding and politics on the avenues available for pursuing their dreams. If they love learning about their chosen field, they’ll be willing to endure the struggles to keep working in it.

Deborah Lenceski (from the *Nature* web site)
<http://helix.nature.com/debates/women/>

A chemical engineer was appearing as a role model at a Women’s Training Roadshow for 2,000 schoolgirls in Wales, UK. The first three groups of girls all asked her the same question: ‘Are you really an engineer?’ ‘Yes’ she said, exasperated, ‘Why do you ask?’ There was a pause. ‘Because you’ve got a handbag’, one of them replied.
 (Rees, 1992)

Role models and mentoring

Women scientists can become exhausted role models but there is no doubt that they can be effective in combating stereotypes. The strength of stereotypes is extraordinary. There are examples from many Member States of women giving their time to visit schools and give talks to encourage girls into science. It is increasingly recognised that promoting the public understanding of science should be an integral part of the job that scientists do, for which they are rewarded. So too, work as a role model to attract girls and indeed women returners to science should ideally be recognised as an essential component of the work package of women scientists for those who chose to do it, rather than as an additional ‘leisure time activity’.

Equally mentoring work is vital to prevent women students feeling isolated. Mentoring can be helpful to build up contacts with professionals, to understand better the culture, how it works and how to challenge it if need be, for psychological support and so on. Mentoring was advocated in the influential Hilden 11-point action plan for promoting women and excellence in science in Denmark (Ministry of Research and Information Technology, 1994). Professional associations and women in science networks can be asked to provide role models for schools, speaking platforms, media appearances and so on (see Tibazarwa and Colosimo, 1999 for a list of women in science networks).

‘Young people, especially girls, are very sensitive to how something looks... Therefore it is important to have more physics teachers looking like the Spice Girls’
 Susan Greenfield, Professor of Synaptic Pharmacology at Oxford University quoted in *The Guardian*, 29/6/99

In France, girls now constitute over a third of students in scientific disciplines in the universities (36%). However, apart from biological sciences, the proportion among students following the elite scientific path (described in Chapter 5) only amounts to between 15 and 30%. This path attracts the best students in science although it leads many of them to a non-scientific career. On the other hand, mentoring in *Ecoles* is much more efficient than in the universities, and it has proved to be useful to push girls whose only ambition is to be secondary teachers, into research careers.

Positive action education measures

There has been a raft of positive action measures designed to attract girls into science and technology, including booklets, roadshows, travelling exhibitions (such as the WISE bus in the UK), science days at universities and so on, but they cannot be said to have been particularly effective. This

is not surprising: on the whole they are one-off, ‘stand alone’ measures and are unable to change the wider cultural context in which they are located. So, while such initiatives are to be welcomed, they need to be part of a broader strategic approach.

In Chapter 3, we identified some special fellowships designed exclusively or particularly for women. Some of these are fellowships earmarked for women returners. In Germany, the special funding programmes in support of higher education and research (HSP) discussed elsewhere in this report as a rare example of mainstreaming gender equality in science policy, includes support for re-entry training for women with child-care supplements. This integration of positive action measures within a broader mainstreaming agenda is far more likely to bear fruit.

When a woman was appointed to the Board of the University of Utrecht, she had to be presented to the City Council. ‘May I please introduce you to our new council member?’ the Rector asked one of the city councillors. Thereupon the addressed looked left and right and straight past the new woman member, and then asked: “Where?”

Opzij, 30/9/1999

Is there a ‘female style’ in science?

The issue of ‘women in science’ has moved on from a concern with access and equal opportunities to a concern with the role of gender in ‘doing’ science. Do women do science differently from men? In 1993, the journal *Science* dedicated a special issue to the question ‘Is there a “Female style” in Science?’ (16 April, 1993). The topic was taken up in the *Scientific American* in an article ‘A Lab of her Own’, by Margaret Holloway in the same year. This is a theoretical question, answered in three different ways. For one group, science is an objective, disinterested activity far from personal input. Any style, and especially a ‘female’ style, therefore, is an unheard of heresy. For a second group, femininity is so essential that any activity undertaken by women bears the stamp of gender. For them, a female style, even in science, is inevitable for women doing science. Some feminist scholars try to avoid the either-or choice between Scylla (belief in total objectivity / identity between men and women) and Charibdis (belief in partiality and essential difference between men and women). They argue that all science is contextual and situated in time, which does not so much relativise objectivity, but localises knowledge.

However, where women have changed science, it is not so much a result of their female upbringing as of the development of gender awareness through women's studies and gender studies. In the last two decades, women scientists and scholars have criticised scientific concepts, methods and methodologies for their unrecognised gender dimensions. They have produced research on women, gender and science which addresses the ways in which:

- science produces definitions of gender through research by over- or under- emphasising gender differences.
- science and scientific methods are gendered in terms of binary opposition such as object- subjectivity, nature- culture, body and mind. (Bosch, 1999).

Conclusion

There has been concern expressed about how education systems appear to deter girls from choosing science subjects for a considerable number of years. It is time to make a more concerted effort to address some of the issues that by now are reasonably well understood. It is particularly important that science expressed through new technologies, including interactive computer games and science exhibitions and museums, do not perpetuate outdated images and myths and act as a chill factor to girls.

Policy points

- Need to combat parental tendency to encourage boys but not girls in science and computing.
 - Girl-friendly computer games needed.
 - Gender equality to be important part of teacher training.
 - Pedagogy to include practical applications of science and technology.
 - Careers guidance to encourage girls in science.
 - Annual science days at universities to encourage girls to choose a scientific career.
 - Information on science to be more accessible; image of science and scientists in museums, projects, media to be revised.
 - Role models and mentoring schemes to be supported.
 - Positive action measures to encourage women to return to science after a career break.
 - Support research into history and culture of science, especially that which makes women scientists visible.
 - Gender analysis of all the documents produced by universities, research institutes and professional organisations of scientists.
 - Gender analysis of popular accounts of science, whether as textual narratives, or documentary films, or (interactive) computer presentations.
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7 Mainstreaming gender equality in scientific institutions and enterprises

This chapter advocates the simultaneous development of equal rights in the law, positive action measures to address disadvantage as appropriate and mainstreaming to integrate gender equality into scientific institutions, policies and practices. The legal right to equal treatment is vital to equality but not sufficient: equal opportunities do not guarantee equal outcome. The 20–25% pay gap between men and women in the EU is testament to this. Hence, a distinction must be made between treating people the same and treating people equally. Positive action addresses disadvantage experienced as a result of the shortcomings of equal treatment. It is the site for the development of good practice. However, to complement these two approaches, the key to combating discrimination, both direct and indirect, inadvertent discrimination, is recognising the differences between men and women and devising systems and structures that respond to those differences – in other words, mainstreaming equality.

Organisations in the scientific community, in common with others, now have a responsibility to integrate gender equality into their activities, following the EC *Mainstreaming Communication* (EC, 1996). This means undertaking an imaginative review of institutions and their operating mechanisms across the board. This chapter, therefore, focuses on the principles and tools of mainstreaming which can be evoked to transform science and scientific institutions. Chapter 9, *Making Change Happen*, translates this approach into specific proposals, which are then summarised as recommendations in Chapter 10.

There are five broad principles underlying mainstreaming and five tools designed to put the principles into practice. They can be summarised as follows.

‘I have always believed that contemporary gender discrimination within universities is part reality and part perception. True, but I now understand that reality is by far the greater part of the balance’

Charles M Vest, President of MIT (following acknowledgement that women faculty in MIT suffer from substantive discrimination in hiring, awards, promotions, inclusion on important committees and allocation of resources and laboratory space). Preface to report, quoted in *Boston Globe* 21/3/99. Report reference: <http://web.mit.edu/fnl/women/women.html>)

Principles of mainstreaming

i) building equality into the culture and organisation

This needs to be done so that equality becomes a natural part of the ‘way we do things round here’. Mainstreaming equality has to be treated just like any other organisational function, such as budgeting or annual reporting. It means integrating the principle of gender equality into mission statements and goals, allocating budgets for activities associated with it, and systematically incorporating equality into training, line management, performance review and annual reporting systems. This is a major challenge and needs to be planned and introduced in a coherent programme. It requires appropriate support structures to ensure it is in place and has systems to deliver it. It means integration – rather than a bolt on approach to gender equality.

ii) treating the employee as a whole person

For most men and women, treating the employee as a whole person principally entails taking their families and the rest of their lives into account in the organisation of work. Employees will have responsibilities for caring for children and, increasingly, elderly relatives. The reconciliation of work and family lives is difficult but can be tackled through family friendly measures and flexibility. There are fewer surprises and emergencies and less stress. Career breaks can be regarded as natural, and returners of either sex should be encouraged to maintain contact. Treating the employee as a whole person also means taking a positive approach to disabilities and ensuring buildings and schedules meet disabled people’s needs. It means valuing personal development, lifelong learning and training activities (whether work related or not) and crucially, combating the ‘long hours culture’, ‘work addiction’ and ‘presenteeism’.

The concept of an academic age

In 1997 the Dutch Association of Women’s Studies filed a complaint before the National Committee for Equal Treatment against the National Organisation for Scientific Research for the use of age bars for several fellowship programmes.

A professor of law did the same against the Royal Academy of Arts and Sciences for their use of age bars in the Academy’s fellowship programme.

Both complainants argued that this rule indirectly discriminated against women.

The complaints were accepted and the Committee ruled that they were justified.

Since then, both organisations have officially adopted the concept of ‘academic age’ Women and men who can prove they had a time lapse in their career for reasons of care may now be regarded as younger than the official age limits.

iii) respect and dignity

This is about honouring staff and students as human beings and affording them respect and dignity. It implies operating a consistent and tough approach to discrimination and harassment (whether on the basis of sex or any other equality dimension), and bullying. There should be a high level of awareness in the work culture that such behaviour is unacceptable and perpetrators should be sanctioned, preferably by termination of contract. All the equality dimensions should be included in such policies: gender, race, ethnic origin, disability, age, religion and sexual orientation.

iv) participation and consultation

For an integrated approach to gender equality, it is essential to foster a democratic culture of consultation and participation and to work towards a sharing of common goals. There should be a high awareness of employees' and students' views about barriers to equality. This means establishing mechanisms for listening and responding to views and suggestions such as equality officers and committees with budgets and power. There should be transparency of decision-making systems. An effective equal opportunities infrastructure, and well-publicised grievance procedures are vital.

v) visioning

This is the most difficult and the most exciting element of mainstreaming. It involves recognising the ways in which current systems and structures, policies and programmes, in effect, discriminate. Some of the most blatant forms of sex discrimination are addressed through the law in most of our countries. However, indirect forms remain. The language used in universities (eg bachelors and masters degrees) can imply students should be male. Privileging seniority (having been in the job for a long time) as a criterion of promotion is one example. The use of the 'old boys' network' as a source of recruitment for jobs discriminates. The long hours' culture benefits those men who do not carry the major burden of household responsibilities. Measuring productivity in terms of quantity rather than quality discriminates against women who take career breaks or are limited in the extra hours they can work by time-consuming domestic responsibilities. There are many ways in which work culture and organisation is based on a notion of a bread-winner male and a home-maker female, even though relatively few (and a declining number) of families live in this way. Visioning means seeing the ways in which current systems rest on this assumption and hence perpetuate patterns of gender segregation and advantage men – through pay, job security, and promotion and training opportunities.

In order to work on these principles of mainstreaming, a number of tools have been developed. At the heart of them is the need for training, to change cultures and practices, to build ownership and to deliver policies.

Tools of mainstreaming

i) gender equality indicators

Gender monitoring is essential to mainstreaming. In the first instance it is necessary to collect baseline data, then to measure progress towards targets. Gender disaggregated statistics tell us about the impact that gender has on who does what. The pay gap, despite equal pay legislation, shows us that equal treatment is not enough to deliver equal outcome. However, raw data are inadequate. Gender statistics need to be cross-tabulated with other variables or else they can be misleading or the meaning becomes obscure. Statistics have to be developed into gender equality indicators. This is sophisticated work (see Chapter 8).

Having made it to tenure and a well-funded lab while still raising my two kids, I am in the US and not in my native Germany in part because the situation in Germany was (and still is) much worse for ambitious women. There are two issues - in Germany, women often decide against a career in science mostly because they perceive it being impossible to have a career and a family. In the US, women do have careers in science, but are not making it to the top to the same extent as men.

One hurdle in Germany (but not in the US) that cannot be changed easily is that society considers it impossible to combine a career and being a mother. The mother peers state that you shouldn't have kids if you plan on having them raised by others while you work, the scientists consider you not quite up to snuff if you want both. ...The few female role models that might be there clearly are not role models for any woman wanting to raise kids while having a career.

The interesting exception is the East, where one generation of women was nearly 100% in the workforce, but that is being dismantled now. This attitude change will only come about with success stories being circulated.

Margit Burmeister, Ann Arbor, Michigan (currently on sabbatical in Berlin, Germany)

Under-utilised women and interrupted careers were a constant theme for Mary Bunting-Smith while she was President of Radcliffe. In an article in the *New York Times* in 1961, she chided society for its 'waste of highly talented educated women power', calling it a prodigious national extravagance'. 'The number of intellectually displaced women without productive outlets for their talents and education is growing yearly. Yet to date our efforts to stem the waste they epitomize have been meagre, scattered and inadequate' 40 years later this is still the case.

Quotations from the obituary of Mary Bunting-Smith in the *International Herald Tribune*

ii) gender proofing/gender impact assessment

Documents need to be gender proofed – do prospectuses only show men with big machines? The curriculum in particular needs to be examined: what messages do worked examples or applications send out to boys and girls, to men and women? What portraits hang in the senior common rooms – what role models do they offer women? New and existing policies need to be assessed for their gender impact. Will charging top fees affect males and females the same? What assumptions underpin fellowship schemes, travel grants and so on about applicants' family responsibilities? Training is essential to ensure that impact assessments are imaginative and effective (see Lindsten, 1998; Verloo, 1997 for guides to gender impact assessment).

iii) building ownership

It is essential that all parts of the organisation sign up to mainstreaming. Commitment from the top has been shown to be very effective in setting the tone but it needs to be followed up with structures and mechanisms that lock the culture in. Some global corporations are experimenting with managing diversity, which has a different philosophy but uses some of the same tools as mainstreaming. They are seeking to embed equality into the culture by setting performance targets and attaching pay bonuses for managers (for example) according to how many women they promote above a certain level during the year! This is a rather crude but nevertheless effective approach in target and performance driven organisations. While it may incur backlash and accusations of tokenism, it motivates managers to identify barriers to women's promotion and remove them. Clearly expertise is needed. Equality units need to be set up or expanded if mainstreaming is to be taken seriously.

iv) awareness raising

One of the main difficulties with equality work is that the complexity of the issue tends to be underestimated. People imagine that discrimination is about 'being nasty' to other people. Such forms of discrimination account for a fraction of cases brought to court. On the whole, discrimination is the result of systems and structures, which manifestly or subconsciously prop up the bread-winner/home-maker myth and the model of the 'gender contract' between men and women that goes with it. Raising awareness among all employees is therefore essential. Gender disaggregated statistics are helpful here in demonstrating the impact that gender has in the allocation of positions. Brainstorms or seminars can help individuals to understand the issue better. Some countries, such as Sweden, bring in 'flying experts' to assist with awareness raising and setting up systems. Self-awareness exercises have been used in the Netherlands to good effect to assess levels of expertise and training need. This brings us to the final and most essential ingredient of mainstreaming – training.

v) training

Training employees in mainstreaming is vital: for visioning, for collecting and interpreting gender equality indicators, for conducting consultation exercises, for building ownership, for carrying out gender impact assessments, for sensible target setting and for establishing monitoring and evaluation techniques to assess progress. If mainstreaming is about

transforming an organisation, then clearly it cannot happen without a significant programme of training to empower and enable staff to deliver it, complementing the other activities and structural arrangements.

Unfortunately, like gender impact assessment exercises, training courses in equal opportunities have sometimes been rather cursory: such courses tend to be short, cheap, focus exclusively on how to avoid falling foul of the law and are generally regarded as unimportant. Often the level of awareness of key issues is so basic, and the subject afforded such a low priority, that training barely scratches the surface. It then has the danger of invoking complacency. A little knowledge is a dangerous thing! Indeed, training in equal opportunities can end up being counter productive.

Letter from a woman scientist

'The few women who stay in science and manage to combine family with work are often very productive. It is obvious that enormous selection has been exerted on the women who remain in science and you have to be highly motivated, highly committed and extremely well organised to survive. You also feel that you must be as productive as possible to convince colleagues that you should be taken seriously as mother and scientist. Looking at who stays in science is only part of the picture. If I look at my female contemporaries during my graduate and post-doctoral studies I am part of only ten per cent of those women who are still in basic science. Many of those have suffered poor career progression due to career breaks to have children. Many stopped when they had children and went into other careers when they went back to work, as they felt the break from research had been too long. In France my colleagues at the CNRS said they get about half the amount of their salary which they pay in childcare as a tax credit. This is in addition to a 'child award' of approximately £100 per month per child. How can France be able to provide family friendly policies when the UK cannot?'

Letter from a woman scientist in her late 30s, working in an UK university with two small children and a partner also working as a research scientist.

Hence, it is vital that training for mainstreaming is embedded in a programme of organisational change, that it is afforded proper priority and that it is resourced in terms of time and money, at an appropriate level. A key problem is motivating people, particularly those who believe they know all about equality from previous courses! This is where incorporating mainstreaming into performance review and assessment programmes has some merit, to motivate staff.

Training needs for mainstreaming occur at different levels for different parts of the organisation: from conceptual (the visioning and gender impact assessment work, essential for managers and above) to technical (such as gender monitoring and developing and using equality indicators). This means that training has to be tailor-made for different actors. It cannot all be covered in one programme. Rather, staged, tailor-made training programmes need to be developed, albeit sharing some common elements. In time, certification for such courses may motivate people to undertake them, especially if such qualifications gain some currency in the job market.

Pilot projects are good learning devices for training in mainstreaming, so individuals can see how it might work in their own context. Bringing in examples from outside and inviting trainees to adapt them for their own purposes can help learning. Benchmarking with other organisations both in the same and in contrasted lines of work can be effective. Equality exchange groups, whereby employers such as universities come together to share experiences and hear from experts can aid the group learning process and be a source of ideas.

Universities are often outraged at the idea that they might be discriminatory, because they regard themselves as very liberal institutions. But they have limited management and personnel departments.'

Tom Wilson, Head of National Association of Teachers in Further and Higher Education (University section), commenting on the results of its survey on the gap between men's and women's academic salaries in the UK.

(Independent 11/11/99)

Conclusion

Mainstreaming is a long-term strategy designed to complement a legalistic approach to equal treatment and positive action measures designed to address pressure points and establish good practice in the removal of barriers. It is in the early stages of development but already some good progress has been and in some sectors. The science community needs now to engage with this agenda and start to integrate equality into its culture and organisations. Many university practices are archaic and redolent of medieval apprenticeship systems characterised by patronage and nepotism. Women tend to lose out in these arrangements but do better in open and fair competition. Mainstreaming gender equality will not only benefit women but will further the goal of excellence in science.

Policy points

- **'Flying experts' register.**
 - **Benchmarking.**
 - **Identification of good practice.**
 - **Equality exchanges.**
 - **Training packages.**
 - **Guidelines to universities, research institutes and industry.**
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8 Gender statistics in science: measuring inequality

It is all too easy to ignore the disastrous effects of direct and indirect discrimination while we are in the dark about the statistics. It is vital that there is a clear picture for all to see. However, it is currently impossible to get a proper fix on the position of women in science, engineering and technology or to make systematic cross-national comparisons or to track changes over time. Gender disaggregated statistics need to be collected, compiled, analysed, harmonised and disseminated on a regular basis, as a matter of course, at institution, local, regional, national and EU level.

Such statistics have a value as both as knowledge and as a policy resource. Indeed, the regular production and use of gender disaggregated statistics in policy development and review is a key element of the mainstreaming approach to equal opportunities, as the European Commission *Communication* (EC, 1996) and the Council of Europe report on mainstreaming (Council of Europe, 1998) both make clear. Moreover, experts on the position of women in science have been calling for a systematic approach to statistics for a long time, both at national and European level (see European Commission, 1999; Logue and Talapessy, 1993).

Existing data for our concerns remain fragmentary, difficult to collate, and non-systematised. Considerable effort was expended in amassing the figures presented in chapters 2-5 and the appendices of this report. Each item had to be asked for separately from the individual statistical office, academy, granting agency or other organisation within each Member State. Sometimes, although the data existed, it had not been collated by the organisation concerned, for example university statistics in Denmark and Switzerland. Although it was relatively easy to acquire statistics on academia from the National Statistics Offices (see footnotes to Table 2.1) it was difficult to get meaningful breakdowns by discipline because different Member States group disciplines differently. It was almost impossible to get data on women in top posts in industry. Such data should be readily and regularly available and used as a management tool. Gender disaggregated statistics are essential at all levels to ensure proper monitoring and evaluation of policy and practice. Finally there is the question of who should co-ordinate, publish and disseminate the data at the EU level?

What statistics already exist

Currently the main source for making EU comparisons is the *Labour Force Survey*. There are indicators available from EUROSTAT within the NEW CRONOS database, which comprises approximately 70 million harmonised data items for the EU Member States. Within the REGIO database, there is information on the regional economies of each EU Member State (*Le Centre Européen d'Expertise en Evaluation* 1998:22). The REGIO database provides 70 standard tables broken down by region including demographics, unemployment and workforce surveys. The latter focuses on working hours, gender segregation and unemployment. *Employment in Europe*, produced annually, includes some statistics disaggregated by gender, particularly in more recent years. Rubery *et al* (1998) have produced an exhaustive account of women's employment in the EU Member States drawing on such statistics as are available. The EC's *Key data on education in the European Union 1997* includes data broken down by gender for students in higher education by field of study. In addition, EUROSTAT (1995) has produced a statistical portrait of men and women in the EU, which includes the results of opinion surveys

However, these sources rarely provide adequate data for examining gender differences in science, engineering and technology for reasons raised elsewhere in this report. 'Medical science' as a category, for example, includes the profession of nursing, a highly feminised area. This obscures gender differences in other areas of medicine.

The recent enhanced focus on gender as a variable in statistical and official surveys more generally is a positive step. Only a clear and direct policy towards gender disaggregated statistics can ensure a continuous collection of information, with data comparable over time and space. In some countries, companies are legally obliged to submit gender disaggregated statistics on their workforces on an annual basis. This is the case in the US and Australia for example. In Italy, the Italian Prime Minister, Massimo D'Alema, and the Minister for Equal Opportunities, Laura Balbo, have recently advanced a law proposal on gender statistics (4 March 1999). The proposal concerns:

- 1 the desegregation by sex of all statistical data;
- 2 the inclusion of gender perspective in population censuses;
- 3 the commissioning of surveys carried out by the Italian Statistical Institute on gender-related issues; and
- 4 the reorganisation of private firms' staff archives by gender.

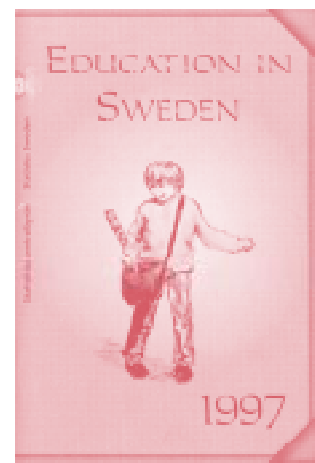
Such data would assist organisations considerably in mainstreaming equality. Available on an EU wide basis, the information would enable better evaluation of policies and programmes. However, such data is unlikely to be collected and made available on a systematic basis without the force of law. A legal approach, then, is certainly one that should be seriously considered.

In Sweden there is an initiative to set up an EU *Gender Institute* which would focus on, *inter alia*, the issue of gender disaggregated statistics at the EU level. This is to be welcomed. Sweden has led the way in collecting and publishing gender disaggregated statistics: *Statistics Sweden*, the main published output from this work, is a best seller. Other Nordic countries have followed suit. However, for European policy development on science research or any other field, while these moves are welcome, a yawning gap remains at EU level for systematised, harmonised data, so that legitimate comparisons can be made. There is considerable work to be done in this field.

Statistics Sweden

Education in Sweden is an accessible, pocket-sized booklet published in different languages including English by Statistics Sweden. It gives a statistical overview on educational attainment, pre-school, compulsory school, upper secondary school, higher education, education, labour market, adult education, educational expenditure and international outlook. Almost all the statistics are broken down by gender. It contains easily understandable diagrams and comments. The picture shows the cover of the 1997 English edition.

The booklet can be ordered from Statistics Sweden, Publication Services, S-70189 Örebro, Sweden. Fax 46 19 17 6444.



In this chapter we highlight what statistics should be collected and by whom, addressing the issues of analysis, harmonisation and dissemination. We discuss the conceptual complexity of gender statistics in scientific research and draw attention to the potential of indicators and indices in this area. The study of indicators of gender differences as a knowledge resource is at a very early stage of development. Moreover, one or more indicators are not enough to describe the status of women and men in scientific careers and to orient policy in the sector. It is necessary to set up a system of mutually related indicators which, besides providing data, could also become an effective tool for policy programming. We conclude with recommendations on who should do what.

What statistics should be collected, and by whom?

It is important to formulate a clear aim as to *why* statistics are being collected: then the figures that are needed become obvious. Gender disaggregated statistics are needed to ensure services are delivered fairly to both men and women, to benchmark with other organisations and to monitor the impact of policies and programmes. Key areas where gender segregated statistics are required are as follows:

From Statistics Offices in the Member States

- Participation rates in education by subject at all levels;
- Participation rates in training, by length, level, and certification;
- Allocation of resources in education and training by gender;
- Employment of men and women in science occupations and professions;
- Cohort statistics and salary information of men and women in scientific careers at all levels in universities, in research institutes and in industry;

From funding agencies in the Member States

- Men and women on boards allocating fellowships and research grants;
- Applications and success rates of men and women to fellowship schemes, research grants, scientific prizes;
- Breakdown of financial investment into science conducted by men and women.

From Ministries in the Member States

- Gender breakdown of membership of elite organisations such as academies that are supported by public funds;
- Gender breakdown of political decision-making bodies allocating science budgets and of key scientific committees that set policy and control funds.

'Scientific research, like every other sector of the labour market, represents a cross-section of society with its inequalities and its relationships with power. It is therefore important to regard the research system and work organisation in science not as a distributor of social positions – on the contrary – scientific careers and research work organisations should be seen as products of society, their values and organisation.

The starting point for studying the status of women in science is obviously always to have data on scientific personnel specified by gender and to know the trends regarding the percentage of women in the various disciplines and at the various grades. This overview must become a routine practice for all the statistical departments of universities and research institutes in the EU. The categories of disciplines should of course be harmonised and occupational grades made comparable at the international level'.

(Rossella Palomba, National Institute for Population Research, Italy)

These proposals are for raw data to be produced routinely by the organisations concerned. However, to be used as an effective management tool, more thought needs to go into developing the potential power of such statistics. For example, the 'scissors diagram' (Figures 2.2 and 2.4) indicates how more women than men, proportionately, are lost to the sciences at each milestone. This is a serious cause for concern. It illustrates that systems and structures of hiring, promoting and retaining scientists have a gendered dimension and that women are more likely to be lost to the subject. This becomes an issue for policy to understand how this is happening and to decide what measures might be effective in changing these curves. For example, in Sweden and Switzerland, targets are now set for recruiting women to positions in universities based on the proportion of women in the tier below, in other words, reflecting the gender composition of the recruitment pool.

Gender indicators in science – a long term goal

Palomba (1999) argues that the transfer in quality and quantity terms from elementary data to genuine information needs a theoretical and conceptual model to give it power and significance. Statistical measurements should therefore be useful both as a specific information contribution and as inputs for possible political actions. She argues that there is a need for a standard set of indicators to measure the impact of programmes on a particular objective. Currently, these are often not broken down by gender, or if they are, the gender dimension is not cross tabulated with other variables, seriously limiting what can be learned and possibly obscuring the impact of the programme. For a programme to develop useful indicators, it needs a regular and reliable set of statistics, to provide a context. Qualitative data are also useful and underused.

Palomba (1999) argues that in developing indicators, models and systems for equal opportunities, it is important to establish the knowledge goal. In the case of women in science, we must establish whether the goal of the statistical indicators is to identify:

- i) a social problem – where women are considered as a vulnerable group in the scientific community with political intervention being needed to protect them;
- ii) a question of fairness – of rights that are being ignored. Political intervention should then aim at balancing differences in the enjoyment of rights;
- iii) a problem of ‘making the most of human capital’ by universities, research bodies and corporation – avoiding the waste of national scientific resources. Here, political intervention should aim at increasing investments geared to ensuring better opportunities for women.

All three are legitimate concerns. How can we use statistics to address them? In this section we focus particularly on the third issue: how can indicators be developed to help us understand how women’s skills are being wasted? How can indicators assist in the development of fairer systems and structures? What investments need to be made to ensure better opportunities for women to study for, remain within and develop in scientific careers? One or more indicators would be insufficient; it is necessary to set up a system of mutually related indicators to provide an effective tool for policy programming.

The first stage is to develop proper statistical measurements broken down by sex. Indicators then need to be developed on access to scientific careers. This implies the analysis of university course choices by men and women as well as the introduction of indicators measuring time factors, such as the average duration of courses and the mean age of students by gender at the completion of studies. It is vital to record gender statistics not just of the winners of competitive examinations but also for the participants. This is the only way to calculate the *success rates* of men and women.

Indices of horizontal and vertical segregation

Most countries can provide a rough idea of the proportion of men and women in scientific careers; however this is not sufficient to plan a wide-ranging policy interventions aimed at reducing wastage. It is important to introduce indicators measuring sex segregation in scientific occupations and professions. Horizontal segregation measures the concentration rate in occupational sectors (or disciplines) without any assessment of opportunities. Vertical segregation concerns the position of men and women within the hierarchies of science.

The statistical measurement most commonly used to measure horizontal segregation is the dissimilarity index, which expresses the distance from an equal gender distribution. The maximum value is 1, which means that only one of the two sexes is present. The minimum is 0 for equal distribution between men and women. The greater the aggregation by discipline, the less the segregation since overall variability decreases. The dissimilarity index must be interpreted together with the simplest indicator of female

presence, the ‘feminisation rate’, which compares the female presence with the total.

We can also compute the number of women (and men) who would have to change sector in order to allow for an equal presence of men and women in each disciplinary group. The same indicator can be calculated by positions.

Table 8.1: Number of men who would have to vacate their positions to achieve an equal sex distribution of Professors in France (1998)

Disciplinary group	
Chemistry, Physics	1,576
Mathematics	1,372
Biology, Medicine	496
Humanities	1,124

Source: Palomba (1999, p 8)

The dissimilarity index has some limits since it is based on the hypothesis that there should be an even gender distribution in every disciplinary group. This is clearly unrealistic and allows for no variation in the process of matching people to jobs since it could be argued that such figures represent a genuine gender difference in preference (Hakim, 1998, p 8). It is nevertheless a useful starting point for raising the issue of gender in the scientific community, which defines itself as gender-neutral.

There are other cautionary remarks to be made when analysing horizontal segregation. An increase of women among members of university staff does not always mean that direct and indirect discrimination has reduced. The abolition of the binary divide between universities and other degree awarding institutions (where women were employed in greater numbers) had the effect of artificially appearing to boost the numbers of women in universities (for example in the UK in 1994/5). The shift from tenured positions to short term contracts in some Member States also appears to have been associated with an increased proportion of women staff in universities. Some institutions increasingly use such contracts as part of a growing secondary labour market, providing research and teaching support to established academics. The incumbents of such short-term contracts, who in most countries are most likely to be women (see Chapter 3), are not necessarily on a career track. Hence indices need to be used with caution. The significance of male dominated networks in shaping the scientific community through the allocation of resources and rewards has been discussed elsewhere in this report. Here we note the increase in the hiring of women in laboratories and scientific institutes but with careers that are blocked (Reyneri, 1996; David, 1994). Decreasing horizontal segregation may therefore be accompanied by a permanent vertical segregation.

The measurement of vertical segregation is the one best suited to measuring the failure to optimise female human resources. The comparison between the percentage of women at the top of the hierarchical pyramid and those at the bottom step is a useful indicator of segregation, especially when compared with the ratio for men. It is particularly important to calculate, of all male academics employed at universities or research institutes, what proportion are in senior grades, and compare it with the figure for women.

However, there are problems here too, since women entered scientific research more recently. In fact, in many bureaucratic structures, where seniority is privileged in promotion to higher grades, women will be relatively sparse in higher grades. Hence a simple indication of the existing situation is not sufficient to demonstrate vertical segregation in scientific research. Instead we require information on the careers of men and women who entered the universities or research institutes *at the same time*. This approach is very powerful (see the German data in Figure 2.3). Specific measurements showing inequalities with the same starting conditions should therefore be used.

Financial segregation

It is important to correlate horizontal and vertical segregation with wage differentials between the two sexes and with differences on project financing in order to understand what happens in the scientific community. Gender inequality and economic inequality are linked but the relationship to gender segregation is not self-evident (Marshall et al, 1988). The Bett Review of academic salaries in the UK found that women earned less than men at every single grade throughout the university hierarchy. Without regular gender audits of pay, such facts remain obscured.

US legislation **requires** universities to keep statistics broken down by gender for all levels of staff. In addition, the American Association of University Professors publishes an annual report listing the salaries paid to women and men at each rank in each academic institution in the US.

Time segregation

In developing time-segregated gender indicators we are concerned both with *biological* and *social* differences between men and women. One of the major biological differences is that child-bearing years coincide with the time at which careers are being built. A major social difference is in the inequalities in the domestic division of labour. Repeated studies have shown men contribute far fewer hours to childcare and domestic responsibilities even when both partners are working. The scientific community, like other areas of work, is predicated upon the notion of an almost unlimited time available for work. Women researchers who want career advancement have historically had to choose between their socially ascribed female role and adopting the 'male model' of total involvement in work. Some women choose to opt out of science because it can be difficult to combine with family life. Gender indicators need to address this issue to demonstrate the extent to which rewarding seniority and unbroken careers and the allocation of long hours of work, in effect, discriminates against women. Better indicators of merit and quality of work would undoubtedly assist women who currently have to divide their time between work and families. Introducing a family dimension and the individual status of researchers into indicators needs to be tackled.

Often demands for total dedication to work are not really necessary for the proper functioning of scientific institutions and the positive outcome of research but has more of a symbolic value. Indeed, research conducted in Italy shows that women are more present on a daily basis in scientific laboratories than their male colleagues. Men by virtue of being more senior, are more likely to be involved in committees, meetings and management tasks that take them away from their laboratories (Benigni et al, 1988).

Harmonisation, publication and dissemination of statistics

The harmonisation, publication and dissemination of statistics relating to gender aspects of research policy is a serious problem which needs to be addressed urgently. In the first instance an assessment is needed of what data is currently collected on national levels. Then serious consideration needs to be applied to the thorny issue of harmonisation. Finally, policies need to be developed on how they should be made as accessible as possible on a Europe-wide basis. Urgent consultation is needed between National Statistics Offices and other interested parties including equality agencies, Eurostat and the sector *Women and Science* in the Research Directorate-General on how to enlarge the database of gender related statistics at Member State and EU levels. This could be done immediately.

Harmonisation

Some of the difficulties of harmonising statistics are apparent from the data in this report. Academic hierarchies and categorisation of disciplines in different countries are often not directly comparable between Member States. Nevertheless, in a united Europe it should be possible to develop guidelines that would make the statistics from different countries easier to compare than at present – using for instance the grades of assistant, associate and full Professor. Some attempt has been made to do this by the Council of Europe. It should be possible to agree on a Europe-wide listing of disciplines and catalogue the data accordingly. It should be possible to collect meaningful and comparable statistics by level for women in industry. The national statistics offices and Eurostat should take the lead in this area.

Publication and dissemination

Even where gender disaggregated data are collected, sometimes, published statistics then do not give a gender breakdown. Some official government publications only publish percentages, omitting raw numbers, or vice versa: both make it difficult to get an accurate picture. In some cases a gender breakdown may be given for one year but not routinely, making it impossible to chart changes over time. Occasionally, total numbers are given and then a sub-heading, ‘of whom women’, indicating the androcentricity of the presentation.

In the UK, a guide to gender statistics has been produced by the Equal Opportunities Commission and the Office for National Statistics that identifies some of the issues, difficulties and sources (EOC/ONS 1998).

It is important to put the data in the public domain but in an accessible form. This is where *Statistics Sweden* has been so successful. ‘Gender-fact cards’, which can be used to distribute to schools and journalists to raise awareness about patterns of gender segregation more generally, are a useful device. Using web pages to disseminate gender-disaggregated data is helpful: some of the Member States equality agencies as well as many of the National Statistics Offices have developed strategies for this.

All publicly funded bodies should include gender-disaggregated data in their annual reports including the position of women and men in the hierarchies.

Conclusion

Gender disaggregated statistics are an essential component of the mainstreaming approach. The Research Council has invited the Commission to produce comparable data and European indicators so that the situation of women in science could be assessed more effectively. This is a topic where there has been general agreement for a considerable length of time that something needs to be done. Now is the moment to begin the work.

Policy points

- **Legislation is required making the production of gender-disaggregated statistics of workforces a requirement for employers.**
 - **Member States and Eurostat should produce statistics disaggregated by gender and by level.**
 - **Member States and the EU should follow the example of Sweden and Finland in publishing handy booklets of statistics disaggregated by gender and level.**
 - **Research on the development of cross-national comparisons should be funded by the Commission.**
 - **Research Councils should monitor applications and success rates by gender, publish annual figures of the quantity of resources invested in men and women and monitor the treatment of gender as a variable in research projects.**
 - **Universities and research institutions should have gender monitoring systems including gendered pay audits.**
 - **Establish the proposed EU Gender Institute in Sweden.**
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9 Making change happen

This report provides ample evidence that gender is a significant determinant of the organisation and funding of science in the EU. This is deleterious for the EU's twin agenda of economic growth and competitiveness and the avoidance of social exclusion. It is contrary to the spirit of the equal treatment articles of the Treaties of Rome and Amsterdam. Mounting concern has been expressed about the problem from a wide range of organisations. Time alone will not redress the situation. The situation of women in science is now an urgent issue that needs a strategic policy approach at a number of levels.

This chapter identifies policy goals to aim for and maps out how to make change happen. Throughout, the tenor of the proposals is in keeping with the notion of fairness and neutrality, the cornerstones of the scientific culture. There is no special pleading for women. Rather, we draw attention to weaknesses in current systems that are the source of indirect discrimination and need to be challenged. We propose improvements that should open science up, not simply to women, but to a wider cross-section of men.

This report draws heavily upon a considerable body of experience from around the globe. The recommendations have been carefully considered in the light of what has already been found to work and what does not. While not all policies necessarily travel to new contexts, many do: we urge they be given serious consideration. Some proposals cost nothing and could be implemented immediately. Of course, other proposals will cost money. But then, so does doing nothing. The economic and social cost of the status quo is incalculable – both to individual women but also to science and to the EU as a whole.

The recommendations target three groups: the EU and its institutions; the Member States and the raft of organisations and institutions that are the caretakers of science, engineering and technology; and scientists themselves, men as well as women. The manipulation of funding is a powerful tool. However, it should be emphasised that EU funding for research comprises only 5.4% of Research and Development public civil spending in Europe. The bulk of R&D public spending comes from national budgets. Hence our focus on Member States to achieve results, on the EU to act as a catalyst and on scientists themselves to lobby for change.

Legislative enforcement in the USA

The US Congress has enacted specific legislation to promote Equal Opportunities for Women and Minorities in Science and Technology. The first Act, in 1981, instructed the National Science Foundation (NSF) to mount an affirmative action programme and to report on the current situation biennially. Past NSF programmes have included Visiting Professorships, Faculty Awards, Research Planning Grants and Career Advancement Awards for Women. These have been integrated and incorporated into the current programme - Professional Opportunities for Women in Research and Education (POVRE) (see <http://www.nsf.gov/home/crssprgm>). The 1981 instruction to monitor progress was highly significant. From 1982 on, a substantial volume of gender-disaggregated statistics, accompanied by in-depth discussion, has appeared every second year (now called *Women, Minorities, and Persons with Disabilities in Science and Engineering*, NSF, Arlington, Va).

Other mechanisms are also in place. The 'contract compliance' clause is highly effective: federal funding can be made subject to the fulfilment of equal opportunities requirements. Another powerful mechanism is the use of class action suits for the enforcement of equal opportunities legislation. This achieved significant progress for women in academia in the 1970s (Chamberlain 1988). Universities can face US\$1 million claims for falling foul of the law; this ensures the issue is taken seriously.

European Member States are susceptible to losing their bright young scientists in the brain drain to the US because of the superior American investment in science. The noticeably better climate for women in science in the US means that there is a particular risk to Europe of losing women scientists. This makes it especially important for institutions to see that women already in science are treated equitably, are given equal resources to their male colleagues and are included in decision making roles at all levels.

Throughout this report we have advocated a three-pronged approach to promoting excellence in science through gender parity: equal treatment, positive action and mainstreaming. This tripartite, complementary approach is in keeping with that of the Commission. However, we argue, in the light of the evidence, that there is a need for all parties to be much more pro-active in driving the agenda forward.

The EU Directives that followed through the principle of equal treatment for men and women enshrined in the Treaty of Rome have made a significant difference. However, they have fallen short of delivering equal outcome, as the statistics in this report and elsewhere bear witness. European Commission co-funded positive action measures have assisted in the development and documentation of good practice, but they leave the practices and procedures of the mainstream that cause women's disadvantage untouched. Mainstreaming, the new EU policy designed to complement equal treatment Directives and positive action measures should prove more effective in the long run. It targets the source of the problem. Some elements of mainstreaming need to be backed up by legislation in order to ensure they are delivered. Existing equality laws in Europe tend to lack teeth, especially when compared with the US. There are inadequate funds for their effective enforcement in most of our Member States. Further legislation needs to be considered at the EU and Member State level. Hence, our emphasis on the need for a complementary, strategic approach to gender equality. We begin with our proposals for legislative change to ensure equal treatment.

Recommendations for legislative change

We propose four new measures:

1. A new Directive requiring employers to keep gender-disaggregated statistics.

This recommendation is for a new Directive designed to ensure that organisations publish systematic and reliable data, disaggregated by gender and level, for monitoring and evaluating their gender equality policies and practice. Such a Directive is needed to guarantee that legislation will be introduced in those Member States that do not have it already. Such national legislation should apply to all employers of 50 or more people, and should cover employment and pay. The statistics should be collected and published in a standardised format throughout the EU so that comparisons can easily be made between Member States.

This will ensure that Member States develop national law on gender monitoring, if they do not already have such measures in place. The laws would require organisations and individuals to equip themselves with the necessary statistical information to know whether men and women are being treated equally. Such information is not readily available on a systematic basis at present. The scope of this proposed Directive would not be confined to employers in the fields of science, engineering and technology but would, of course, include them.

2. New Member State laws on gender balance on public bodies

In order to achieve a better gender balance on public bodies, including those in the field of science, laws are needed at Member State level (where they do not already exist) to provide for this. The amendment to the *Gender Equality Act* in Finland, passed in 1995, requires national committees, including the National Research Councils, to have a minimum of 40% of both genders. In Italy, legislation requires public competitions for hiring and promoting people, for example at universities and research councils, to have a minimum of 30% of each sex. These and other examples should be emulated.

Recent Italian legislative initiatives

Following the Beijing UN Conference on Women (1995), the Italian Government took some legislative initiatives. The first was a Directory of Actions to be taken by Italian Ministries with the aim of promoting the empowerment of women and the inclusion of the gender dimension in every policy action (Prodi/Finocchiaro, 27 March 1997). The Directory recommends, among other things:

1. promoting the presence of women in every decision-making body;
2. mainstreaming gender equality;
3. the production of gender statistics;
4. increasing awareness of gender issues in a socio-cultural context;
5. the promotion of female occupations;
6. support for female entrepreneurs.

Following this Directory, under point 1, the Minister for Public Employment established the rule that at least one third of the members of the commissions for public competitions both for recruitment and promotion should be of “the other sex”.

3. New Member State laws on access to public records

Laws that facilitate good public access to public documents are useful safeguards against discrimination and nepotism. We note the advantages afforded by the transparency of public information in Sweden, which allowed the unique analysis presented in the Wennarås and Wold study. This cast doubt on the fairness and rigour with which the peer review system was being operated, and enabled the Swedish MRC to reform its procedures and improve the standards of objective assessment of scientific excellence. We recommend all Member States allow public access to records to facilitate opportunities for scrutiny that may enable other research bodies to improve their performance.

A Dutch legislative initiative

In 1997, a Law on the Equal Representation of Women in leading positions in Education was passed in the Netherlands. This law forces universities to set targets and come up with measures to reach these targets. Though not taken seriously by universities at first, under pressure from the growing sense of urgency regarding the under-representation of women, more and more universities are developing structural plans to further the promotion of women.

4. The removal of existing laws and regulations that impede the advancement of women

Some laws and regulations restrict women's chances of making a career. Checks need to be carried out by Member State ministries and gender equality agencies and/or women's units in government departments for those that result in indirect sex discrimination. Some examples of laws and regulations relevant to women and science that fall into this category are:

- the restriction in Germany of untenured assistant scientist positions to five years. Five years is a very short time in science. The solution is to allow some flexibility in interpreting the regulations. For example, in the US, assistant professor positions can often be extended by defined time intervals if a woman has had a child or children while holding the position. In France, age limits for applying, for instance, to CNRS are extended for a year for each child and removed altogether if a woman has had three or more children.
- in some European countries, the protection of the unborn results in it being impossible for a woman who is pregnant or breast feeding to enter a laboratory at all. Instead, guidelines should be available as to what activities should be avoided by women during pregnancy.

Recommendations for developing gender-disaggregated statistical data

Reliable statistical data, collected on an annual basis and disaggregated by gender are an essential prerequisite for reviewing the effectiveness of equal opportunities policies. We propose, in addition to the Directive and accompanying legislation at Member State level referred to in the previous section:

1. A commitment to developing gender-disaggregated data

A commitment by national statistics offices in Member States and by Eurostat to collect and publish gender-disaggregated data.

2. Development of policies about what statistics to collect

Decisions need to be made about which statistics should be collected. There is a role here for gender equality agencies to work with national statistics offices and Eurostat. Suggestions include gender by academic rank, discipline and pay for universities and research institutions, and gender by management level (upper, middle or low) and pay for industry. Application and success rates for grant bids should be monitored by gender by funding bodies.

3. Development of equality indicators

The development of equality indicators harmonised across the Member States (and indeed beyond) on education participation; training; employment and salaries in the sciences would be invaluable in the development and review of policies.

4. Dissemination of statistics

The publication of handy booklets of statistics relevant to education and science at the Member State and at the EU level, as well as the development of central websites would facilitate wide dissemination. This in turn would contribute to public accountability.

Recommendations for mainstreaming equality in the Fifth and Sixth Framework Programmes

In the first four Framework Programmes, little or no attention was paid to gender aspects of research policy. The breakthrough came with the inclusion of the phrase 'requiring that the Community Equal Opportunities Policy must be taken into account' in the implementation of the Fifth Framework Programme. As a result of this, the Commission adopted the *Women and Science Communication*, it developed an action plan and it created the Women and Science sector within the General Directorate for Research. This, in turn, has provided the impetus for the 'Gender and Science Watch System': a working group made up of staff from relevant Commission Directorates. This latter group is to implement the gender and science watch system within the specific Programmes and the Framework Programme in general. In addition, significant headway has been made in the last two to three years towards a gender balance on Commission committees such as the Advisory Groups to the Fifth Framework, as we document in Chapter 5.

A pro-active approach to mainstreaming gender equality into the Sixth Framework Programme would be in keeping with the Amsterdam Treaty, the Commission's Communication on mainstreaming generally (CEC 1996) and the Research Directorate-General's Communication on mainstreaming gender equality in science specifically (CEC 1999). It would also be in line with the European Parliament's Resolution on the Commission's Communication prepared by the Committee on Women's Rights and Equal

Research Directorate-General: Women and Science sector

The Women and Science sector was established in the Research Directorate-General on January 1st 1999. Its activities are presented on the Internet at the following address: http://www.cordis.lu/improving/src/hp_women.htm.

Opportunities (1999/2106(COS)). It is also worth noting that the new regulations for the Structural Funds to take effect in the year 2000 include as one of the main objectives the promotion of equality between men and women.

This is an excellent time to consider how gender equality could be thoroughly mainstreamed into the Sixth Framework Programme while it is still at the design stage. However, there are also some opportunities to develop good practice and to pilot projects within the Fifth Framework Programme. In addition to commending the specific examples of good practice that we identify in this Report, we propose that the following combination of mainstreaming and positive action measures should be features of the organisation of the Sixth Framework Programme.

1. Ensuring a gender balance in scientific decision-making

- including more women on key committees that set policy, on the panels that give grants and on the expert and monitoring panels set up by the European Commission. We propose a minimum of 30% of both genders on such committees by 2002 and 40% by 2005.
- organisations in the Member States asked by the Commission to nominate individuals to scientific committees should be asked to consider the gender balance of their nominations.
- increasing the number of women at grades A1–A3 in the Research Directorate-General.
- refusing to fund meetings that do not contain a sufficient number of women speakers (related to the proportion working in the field).

Women at meetings No 1

'... as a member of a National Institute of Health Study section I have been repeatedly disappointed to see proposals for meetings in which very few women have been invited. Invariably the organizers of such meetings are well-established men, while comparable meetings with women organizers include a reasonable proportion of articulate women doing good science. With time, some change is inevitable but, in my opinion, women have been waiting long enough and are tired of it. If faster change cannot be brought about by persuasion and feedback, as experience suggests, then stronger pressure has to be applied by funding agencies who want to promote a fair hearing for the women students they pay to train and support.'

From a letter to *Nature* by Brigid Hogan. *Nature* 360, 204 (1992)

Women at meetings No 2

Perhaps one of the most effective measures in the US has been not to pay for meetings unless women are included as speakers. This policy, which was introduced by the NSF Biology Directorate, is based on a memorandum which states that in 1991 women formed 49% of those getting BA degrees and 34% of those getting PhD degrees in biology. It goes on to state 'In view of these statistics, it would only be under the most extenuating circumstances that the directorate would support conferences, meetings, workshops or international congresses that have no women on the program.' In Europe, in the 1990s, meetings are still organised which contain no, or only a single, female speaker even in fields where women are relatively well represented. Those in charge of conferences for the Fifth Framework Programme should insist that a reasonable number of women are included as speakers and chairs, as a condition for funding the meeting.

2 Ensuring attention is paid to the gender dimension of research

Due attention should be paid, where appropriate, to the gender dimension of science. Thus:

- projects on one sex only should not be funded without an adequate justification.
- gender studies should be eligible for funding under the Programme.
- gender mainstreaming should be included among the activities monitored by the Programme Monitoring Panel and the Monitoring Panels for each of the thematic and horizontal programmes for both the Fifth and Sixth Framework Programmes.
- technical assistance projects should be funded in the Fifth and Sixth Framework Programmes to develop guidelines, training packs and worked examples on mainstreaming gender equality into projects.
- the Research Directorate-General, in anticipation of the Sixth Framework Programme, should consider hosting a conference on this issue, with invited expert contributors.

3. Ensuring adequate expertise

There is a need to develop expertise on mainstreaming gender equality into the entire Framework Programme, in particular to assess the integration of a gender dimension into scientific research projects at application, monitoring and evaluation stages. Hence, we advocate:

- equality training for Commission staff, and expert and monitoring panel members responsible for the Framework Programmes.
- hiring 'flying experts', as appropriate.
- providing sufficient resources to the Women and Science sector so that it can develop the necessary expertise.
- supporting the proposed European Gender Institute in Sweden

Women scientists: how to participate in the Fifth Framework Programme

There are many ways to take part in the Fifth Framework Programme, but there is one basic rule - no participation without an application. Women scientists need to submit proposals, and/or apply to be an expert evaluator. The Women and Science sector website http://www.cordis.lu/improving/src/hp_women.htm gives access to information on fellowship and grant Programmes of the Fifth Framework. Individual scientists can submit proposals, and/or apply to be an expert evaluator. In each country and for each programme, there are national contact points to help individuals find their way through the Fifth Framework. The website Cordis <http://www.cordis.lu> presents all relevant information about the EU's research policy. Individuals or organisations wanting to take initiatives to promote women in science can apply for financial support through the call for accompanying measures of the *Improving Human Potential* programme, published in the *Official Journal* (OJ L68/11) on June 16 1999. This information is also available at the web sites given above..

Recommendations for new specific activities within the Sixth Framework Programme

These proposals are for positive action initiatives, which we feel are important both for women in science and for science in Europe. The first three specific activities - *EUROGROUPS*, *'One Time Grants'* and *network funding* - are designed to support scientists at key stages in their careers and to address specific barriers that have been identified as facing women in the

statistics and research featured in this report and elsewhere. The proposals are described in more detail in Appendix IX

1. EUROGROUPS

This is a proposal for a new scheme to provide support for scientists setting up independent groups in the Member States. EUROGROUPS would be open to both men and women but the aim would be to seek to achieve a minimum of 40% of each gender among successful applicants. This would be accomplished by ensuring that the scheme was attractive to women and drawing it specifically to their attention, rather than by positive discrimination or compromising on quality. The availability of such opportunities is crucial in retaining women in science at this critical career stage.

2. 'One Time Grants'

This scheme provides funding for those who need small amounts of money to establish international contacts or who need to kick-start their careers. While both women and men may find that their family responsibilities prevent them from taking full advantage of fellowship or junior group schemes, it is a problem particularly faced by women. They may not be able to put aside commitments such as child-care or eldercare for sustained periods of time, or take dependants to a foreign country. Hence, creating access to a fund supplying relatively small amounts of money to work for short periods in other laboratories, or for comparable purposes, would provide an opportunity for developing an international profile and experience.

3. Network funding

Support for networking is necessary to increase communication both among women in science, and between women and men scientists. The development of networks linking individuals interested in different disciplines or different topics is an important means of exchanging information among individual scientists and fostering the European scientific community. The 1999 meeting organised by the Commission in Brussels of individuals concerned with running such networks for women ('Networking the Networks') demonstrated the need for financial support for networking activities (see Appendix II). The amount of money required is relatively small, and efforts should be made to find funds to support several such networks in a trial phase in the Fifth Framework Programme. Funding should then be continued as a specific activity in the Sixth Framework Programme.

4. Support for specific initiatives

We propose support for:

- meetings organised on a European level by 'women-only' groups concerned with science, engineering and technology.
- innovative projects where it is clear that women in science will be the primary beneficiaries.
- a novel sub-programme, 'Women and the Information Society', to increase the number of women trained in information and communication technology.

- the establishment of a new prize at the European level, to be given to an excellent female researcher (or, one of the existing prizes should be awarded alternately to male and female scientists).

Recommendations for Member States and their institutions

In view of the extraordinary persistence of gender inequalities in science, our proposals to the Member States and the wide range of institutions within them are aimed at producing radical change. Some recommendations mirror and reinforce those addressed to the EU above. They include equal treatment, positive action and mainstreaming measures:

- developing ‘best practice’ policies in the recruitment and employment of scientists.
- monitoring progress, through systematic collection, dissemination and use of gender-disaggregated statistics.
- taking active steps to close the gender pay gap.
- achieving a better gender balance in top scientific positions and on committees that set policy.
- ensuring high quality standards in peer review and selection procedures.
- supporting positive action measures to overcome particular barriers or to kick-start change.
- developing and using expertise in gender mainstreaming.
- funding research on women and science.
- ensuring that the gender dimension of research is developed.

These are discussed in turn

1. Developing best practice policies in the recruitment and employment of scientists

Use of the old boy network and invitations to fill chairs disadvantages women. We urge public and private sector employers to ensure that their employment policies are fair and effective. This means:

- open, transparent recruitment systems, including advertising all jobs.
- good quality training in equality for all those involved in recruitment.
- mixed-sex appointment panels.
- removing structural barriers to women’s recruitment, retention and promotion.
- ensuring researchers whose salaries are funded by grants are eligible for normal social security sick pay and parental leave.

In addition, science is an international and competitive enterprise. We do not wish to restrict those scientists who by choice spend much of their time in the laboratory. However, we do note that the ‘long hours culture’ can act as a ‘chill factor’ for some women (and for some men). All employers need to encourage a good balance between work and home life for all employees and to have policies in place for those who wish to return to science careers after a break. This means:

- addressing the long-hours culture seriously, operating flexible working hours.
- providing good parental leave arrangements and having childcare and eldercare policies in place; tax relief for child-care.
- developing career-break schemes and policies to accommodate the needs of employees returning after a career break.
- providing child-care budgets in travel grants for conferences

2. Monitoring progress

To monitor progress towards gender parity in academia, annual gender-disaggregated statistics should be compiled. For universities and research institutes, the following factors should be included:

- applicants and recipients of positions.
- salaries (including components such as honoraria).
- staff at each level of the academic hierarchy (undergraduates, PhD students, research assistants, assistant professors, associate professors, full professors).
- proportion of work time members of faculty spend on activities other than research (teaching, student and faculty guidance, administration, patient care etc).
- members of top faculty and university committees.
- senior managers of universities and research institutes.

For research councils and other grant awarding and organisations and funding bodies, statistics should be collected, analysed and published on the following factors:

- membership of boards and committees.
- referees used for peer review.
- awardees of research grants.
- total amount of funding.
- average size of research grants (with confidence intervals).

3. Closing the gender pay gap

The Bett report in the UK is one of the few EU studies to document systematically the size of the gender pay in the university system. It demonstrated a significant gap at every level of the hierarchy. Its stark findings illustrate the need for annual published gender pay audits in universities and research institutes. Eurostat data show that 25 years after the Equal Pay Directive, there is still a 25% pay gap between men and women in the EU. A proportion of this is the direct result of illegal sex discrimination. We therefore recommend that universities and research institutes:

- pledge to abolish the pay gap by the year 2005.
- publish gender pay audits annually.
- commission research better to understand the nature and causes of the pay gap.
- benchmark across Member States.
- bring in experts to address the issue.

- make it the responsibility of senior managers, use it as a performance indicators for departments, use rewards and sanctions to encourage departments to take the issue seriously.
- take active and appropriate steps to close the gap.

4. Achieving a better gender balance in universities, research institutes and top committees

This issue was partly addressed under the section on legislative changes. In addition, drawing on gender-disaggregated statistics, each public sector organisation employing scientists (principally universities and research institutes) should set recruitment goals with the aim of abolishing gender imbalance where it is found to exist. This must be totally endorsed by the institutions in question and viewed as an issue of top priority. Recruitment goals should be based on the proportion of women in the recruitment pool. For example, for the lowest rank of the academic ladder, the goal would be set according to the gender ratio of PhD candidates. Where women make up 30% of those earning PhDs in a particular field, then they should constitute roughly 30% of the scientists or faculty members at each level of the academic hierarchy. Gender imbalance can be most speedily abolished by ensuring that newly recruited members of individual departments mirror the gender proportion found among junior scientists in that particular field. Incentives and sanctions can be used to promote compliance of recruitment goals. Recruitment plans should span short time periods (3–4 years) and be evaluated at the end of each period and then, if necessary, revised.

Committees should seek open nomination for members and use women's networks as well as men's to canvass applications. Funding bodies should seek to ensure their membership balances the gender ratio in the respective field.

5. Ensuring high quality peer review and selection procedures

All funding bodies should:

- adopt and strictly adhere to guidelines for the avoidance of sexism and nepotism.
- raise awareness among committee members as to how prejudice may interfere with the evaluation process.
- seek to achieve an appropriate gender balance on committees and among referees.
- monitor and review application and success rates by gender.
- regularly scrutinise their peer review processes and outcomes, including referee selection procedures, to ensure adherence to highest standards and the elimination of indirect discrimination.

Women's Units in Government Departments: United Kingdom

The Unit is called *Promoting SET for Women*, and is located in the Office of Science and Technology. The current head is Jan Peters and it has a staff of four. The Unit's key aims are to work with all other organisations in the SET (science, engineering and technology) area and when needed, co-ordinate and focus on:

- attracting more girls into SET subjects;
- promoting SET as a fulfilling career in industry, higher education and the public sector at all levels, including returners; and
- identifying ways of improving progression for women up the career ladder.

The Unit has produced excellent material to attract girls into science – one of their posters is reproduced on page 58. This unit, which was originally called the Development Unit for Women in SET, was set up in December 1994 and was charged with taking forward the recommendations accepted by the Government in response to the *Rising Tide*. One example of its early work is the booklet *Making the Most*, highlighting the economic benefits of family friendly employment practices and produced together with Opportunity Now. Contact details can be found at <http://www.set4.women.gov.uk>. The Unit's work is now complemented by that of a *Women's Unit* set up in the Cabinet Office, responsible for promoting a mainstreaming approach to gender equality in all Government Departments.

Women's Units in Government Departments: Germany

The Unit is called "*Women in education and research*" and is in the Federal Ministry for Education and Research (BMBF) in Bonn. It is part of the central directorate concerned with policy strategy. The head of the unit is Helga Ebeling. There are seven full-time employees (with external support from three additional scientists and one administrator). It has a budget of 3,75 million euros in 1999. Its task is to implement gender mainstreaming in all programmes and activities funded by the Ministry. It advises other units and directorates at an early stage in designing new programmes. It then sees that indicators, benchmarks, and special activities are integrated into the programmes. One example is the new programme *Innovation and the working place in the information society of the 21st century*, accepted by the Cabinet on September 22nd 1999. The unit also has in addition a monitoring function.

Contact details can be found at the BMBF web site: <http://www.bmbf.de/deutsch/arbeit/index.htm>
E mail address: helga.ebeling@bmbf.bund400.de

6. Developing and using expertise in gender mainstreaming

Here we advocate the following:

- establishing women's units in science or education ministries in Member States where they do not already exist.
- consulting gender equality agencies, using 'flying experts'.
- training in equalities and mainstreaming, use of secondments to gain experience.
- benchmarking with other organisations, membership of equality exchanges.
- publishing examples of best practice, research, seminars and conferences on key issues.

7. Positive action

Positive action measures, although limited on their own, can be a powerful means of kick-starting change, and provide an incentive to the development of good practice. The Amsterdam Treaty allows for positive action for individuals in under-represented areas. However, such measures can prove more effective when used to tackle group disadvantage. There is plenty of scope for developing positive action measures in a wide range of arenas

related to women and science. Areas in which an impact can be made include:

- actively encouraging girls into science through the development of female-friendly teaching methods and teaching tools, pedagogic innovation, role models and mentors.
- helping women returners back into scientific careers (two outstanding examples are the Dorothy Hodgkin Programme in the UK (see p.39) and the HSPIII Programme in Germany, with its palette of opportunities for contact and re-entry stipends, and work contracts (see Appendix I). Similar programmes should be established in all Member States.
- ring-fencing funds for women scientists, e.g. the FREJA initiative in Denmark (p.26)
- supporting role models schemes and mentoring programmes.
- creating positions to address gender imbalance at the top of the academic hierarchy, e.g. the Tham Professorships in Sweden (p.26) and the C3 Programme of the Max Planck Society (p.26).

To date, positive action measures have tended to be short-term, piece-meal and precariously funded. They need to be put on a firmer basis in recognition of the entrenched situation described in this report. Such measures should be directed towards diminishing the disadvantage that some women in science currently face. The lessons from the measures should then feed into the design of institutional change. Positive action should be used as a tool for change, not as a stand-alone response to gender inequality.

8. Research

Research needs to be conducted in a number of key areas to inform policy development. These include:

- the development of pan-European harmonised statistics on academic disciplines and hierarchies, facilitating cross-national comparisons and making available an EU-wide gender-disaggregated database.
- projects designed to explain the 'leaky pipeline', the widespread drop out of women building a scientific career and the pay gap.
- issues of retention and promotion exploring the various factors, including the glass ceiling, that lead to such a scarcity of women in top jobs.
- systematic evaluation, on a pan-European basis, of the effects of positive action measures.
- the workings of the peer review system, to ensure the highest standards of neutrality and objectivity.

9. Improving the gender dimension of scientific projects

Identifying the potential for a gender dimension to research is new territory for many scientists, and argues for closer collaboration between natural scientists and social scientists, especially those focusing on gender studies. The integration of such a dimension leads to better science, and we therefore urge the funding bodies to insist on better standards in this respect. The following would assist in this goal (complementing activities we recommended with regard to the Framework Programmes listed above):

Positive action in Austria

'Female applicants showing at least the same qualifications as the best suitable male co-applicant for a higher position (function) shall, in accordance with the requirements set out in the plan for the advancement of women, be given preferential treatment with regard to such appointments as long as the share of women in the total number of higher positions held by civil servants in a specific service grade within the sphere of activity is at least 40 per cent. Where a service grade for civil servants corresponds to that for employees, the latter shall be included in the calculation...'

Part 4 Section 43 of the Federal Treatment Act, Federal Law Gazette, cited in Hofmeister (1998:155)

- insisting that proposals to conduct research on one gender only have to be justified and assessing the justification for its validity.
- monitoring and evaluating funded research needs to include attention to the gender dimension as a quality criterion where appropriate.
- sponsoring seminars aimed at bring gender experts and the science community together.
- publishing guidelines and worked examples focusing on mainstreaming gender equality into scientific projects.

Recommendations to ensure change happens

1. Monitoring

The importance of monitoring all programmes at the EU and Member State level by gender cannot be over-emphasised. Monitoring activities are of particular importance for programmes designed to increase the number of women in science and technology, to see if they actually achieve their goals.

2. Ensuring progress by redirection of funding

The most powerful method of ensuring progress is through the redirection of funding. Hence:

- withdraw funding from individuals/organisations that do not pay attention to the gender issue.
- increase funding to individuals/organisations that do pay attention to gender.

Utilising female capital

'One reason the American economy is so prosperous compared with other industrialized nations is that they don't utilize their female capital like we do'

(William Dunkelberg, chief economist for the US National Federation of Independent Businesses)

Building a consensus for further action

Advancing the agenda for women in science at the European level needs input from many sources.

- *The EU:* Commissioners (especially Philippe Busquin, the Commissioner for Research); the Council of Ministers, the European Parliament (especially the Committee on Industry, External Trade, Research and Energy, and the Committee on Women's Rights and Equal Opportunities); CREST, the Equality Advisory Committee; the Commission itself, and the Social Partners (the employers' and trade unions' organisations at EU level). It is a particularly opportune time to enlist the help of these individuals and organisations, since the Commissioners and the European Parliament will be in office for the next four years.
- *Member States:* Bodies that develop science policy and fund or support scientists and scientific projects, as well as institutions that educate, employ and manage scientists. Specifically we call upon national education, employment and science ministries; gender equality agencies; universities and research institutes; research councils, charities and other grant-giving bodies; scientific academies and committees that award prizes for science to consider, debate and take up our recommendations.

- *Scientists themselves (men as well as women)*: Lobbying and protest by women was an important factor in achieving change for women in science in the US. Therefore, we encourage scientists to lobby politicians at national and European level and to raise questions in the press. Using personal contact or web addresses to ask such individuals to ask questions in the Parliaments concerning women and science is important. Collective action is more effective than isolated actions by individuals.

In conclusion, ‘waiting for equality’, as we have demonstrated, will not work. Making an investment in educating girls in science, but then not addressing the direct and indirect forms of discrimination and disadvantage they face in employment is enormously wasteful. Indeed, tolerating the existence of barriers preventing women from achieving their potential in science is neither economically prudent nor is it socially just. We therefore invite institutions at EU, Member State, regional and local level and individuals whose activities bear upon the shaping of the scientific agenda and the education, employment and funding of scientists to discuss, consider and take practical steps to implement the recommendations in this report with all speed.

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Resources

EC Medium Term Community Action Programme on Equal Opportunities for Women and Men (1996–2000) *Did I say hairdressing? I meant astrophysics* (film 14 mins) Subverting themes from traditional stories, this ‘entertaining and thought provoking’ cartoon film helps to show why women are under-represented in science, engineering and technology.

<http://www.leedsanimation.demon.co.uk>

Electronic mailing lists

EQ-UNI is a European electronic list for discussions and information on gender equality in higher education from practical and theoretical points of view. The list has over 250 subscribers from 30 countries. To subscribe, send an email with a message SUBSCRIBE EQ-UNI to MAJORDOMO@HELSINKI.FI. The list owner is the University of Helsinki and the contact person and list moderator is Liisa Husu (liisa.husu@helsinki.fi)

European Women in Mathematics (EWM)

to subscribe, write to: ewm-uk-request@mailbase.ac.uk

send messages for the list to: ewm-all@mailbase.ac.uk

Women into Computing (WiC-list)

to subscribe, write to wic-request@keele.ac.uk

Daphnet is for and about women in science and engineering, including returning after a career break. To subscribe, send Your Name to listserv@ic.ac.uk

leave the subject line of your message blank.

send messages for the list to: daphnet@ic.ac.uk

http://research.umbc.edu/~korenman/wmst/f_sci.html

Women related Science/Technology e-mail lists (directory of electronic mailing lists)

Websites

Many of the web sites listed here come from the AWiSE site (www.awise.org):

Women in the Sciences, Engineering and the Technologies

<http://www.awise.org> AWiSE, Association for Women in Science and Engineering

<http://www.math.helsinki.fi/EWM> EWM, European Women in Mathematics

<http://www.gasat.org.uk> GASAT, Gender & Science & Technology

<http://gab.wigsat.org> Gender Advisory Board, UN Commission on Science and Technology for Development

<http://gstgateway.wigsat.org> Gender, Science and Technology Gateway

<http://chemistry.rsc.org/lap/rsccom/wcc/wccindex.htm> Royal Society of Chemistry Women Chemists Network

<http://www.geocities.com/Wellesley/3952> WiPG, Women in Physics Group of the Institute of Physics

<http://www.cant.ac.uk/misc/wes/weshome.html> WES, Women's Engineering Society

<http://pingu.salk.edu/~forsburg/bio.html> Women in Biology Internet Launch Page

<http://www.ae.ic.ac.uk/wset/home.html> WSET Women in Science, Engineering and Technology

<http://www.swe.org/> Society of Women Engineers

Information and Communication Technologies

- <http://foldoc.doc.ic.ac.uk/foldoc/index.html> Computing Dictionary – Free Online
<http://osiris.sunderland.ac.uk/wic/> Women into Computing
<http://www.ai.mit.edu/people/ellens/gender.html> Women in Computing, Science & Engineering

France

- <http://www.edu.polytechnique.fr/Filles/Filles.html> reports on women in classes preparing the selective exams for entrance in Scientific French High Schools (1997); women in French Engineering schools (1998); the situation of women in French civil service, including Education.
<http://www.desargues.univ-lyon1.fr/home/fem/fem.html> the Association Femmes et Mathématiques (French women and mathematics association)

Germany

- <http://www.ipp.mpg.de/cg/hgf/ak-www/akfifz.html> Network women in research centres of the Hermann von Helmholtz Association
<http://www.bukof.de/> Network of Equality Commissioners in higher education
<http://www.ipp.mpg.de/cg/b/fb.html#mpg> Network of women in Max-Planck-Society
<http://www.wgl.de/Frauen/Haupt.html> Women in the WGL Institutes
<http://ais.gmd.de/MUFFIN/> Network: Women in Informatics
<http://www.frauen-technik-impulse.de> Initiative: Women give New Impetus to Technology – information/networks: Women in science and technology
<http://www.informatik.uni-bremen.de/grp> Summer university: women in informatics at Bremen University

Netherlands

- <http://www.vhto.nl/en-index.html> VHTO National Organisation of Women in Higher Technical Education and Technical Professions
<http://www.wins.uva.nl/misc/nimf/nimf.html> Network of women in Computer Science, Mathematics, and Physics
<http://www.tech-women.nl> Tech Women To bring technology closer to people
<http://www.iiav.nl/homeeng.html> International Information Centre and Archives for the Women's Movement
<http://www.dse.nl/ireen> Stichting IReen, netwerk voor technische vrouwen, Network for technical women. (NL)

Spain

- <http://www.seui.mec.es> Secretaria de Estado de Universidades Investigacion y Desarrollo
www.mtas.es/mujer Instituto de la Mujer
www.uam.es/estructura/instituto/IUEM/paginas Instituto Universitario de Estudios de la Mujer

UK

- <http://www.awise.org> A WiSE, includes a good listing for the UK Research Councils

<http://www.sst.ph.ic.ac.uk/trust/> The Daphne Jackson Memorial Fellowships Trust
<http://www.sc.ic.ac.uk/~mcfa/com/tf4/jobs.htm> Marie Curie Fellowship Association
<http://www.wellcome.ac.uk> The Wellcome Trust

USA

<http://www.awis.org> AWIS Association for Women in Science
<http://www4.nationalacademies.org/osep/cwse.nsf> CWSE; Committee of Women in Science and Engineering of the US National Academies
<http://www.witi.com/> Women in Technology International
<http://www.aps.org/educ/cswp/cswp.htm> Committee for status of women in physics at the American Physical Society
<http://www.catalystwomen.org/pubform.php3> catalyst women organisation, provides reports
<http://www.nsf.gov/sbe/srs/nsf99338/> NSF updated report on women, minorities and persons with disabilities in science and engineering. 1998.

Third World

<http://www.ictp.trieste.it/~twas/TWOWS.html> Third World Organisation for Women in Science (TWOWS)

Public Understanding of Science, Science News and Resources

<http://www.alphagalileo.org/> AlphaGalileo-European SET News
<http://www.bbc.co.uk/sia> BBC Science in Action
<http://www.britassoc.org.uk> British Association for the Advancement of Science
<http://fundingopps2.cos.com> Community of Science (COS) Funding Opportunities around the world
<http://www.esf.org> European Science Foundation
<http://www.Southern.com/natasha/women/gateway/gateway.htm> Euroscience
<http://www.lgu.ac.uk/fawcett/main.htm> Fawcett Library
<http://livlib.eduweb.co.uk> Living Library
<http://www.madsci.org> Mad Scientist Network – Answering Science Questions
<http://www.novartisfound.demon.co.uk> Media Resource Service (MRS) scientific information
<http://www.set4women.gov.uk> Promoting SET for Women Unit, OST
<http://www.gn.apc.org/sgr> Scientists for Global Responsibility
<http://www.sciencenet.org.uk> Science Line
<http://www.nmsi.ac.uk> Science Museum
<http://www.tquest.org.uk> Techniquet
<http://www.unesco.org/> United Nations Educational, Scientific and Cultural Organisation
<http://www.engc.org.uk> WISE Campaign; Women into Science and Engineering
<http://www.ae.ic.ac.uk/wset/home.html> WSET Directory of UK organisations related to women in SET
<http://www.youngeng.org/> Young Engineers

Education

http://www.ase.org.uk	Association for Science Education
http://k-2.stanford.edu/creatures	Teaching Fundamental Biology (Virtual creatures)
http://www.engr.ucdavis.edu/college/information/gender/	Creating gender equity in your teaching, Gender Equity Handbook, from the University of California, Davis
http://www.cs.wisc.edu/~karavan/afl/home.html	Exploring Your Future in Math and Science (Designed for high school aged girls)
http://www.where.ic.ac.uk	Women in Higher Education Register

Equal opportunities

http://info.lut.ac.uk/orgs/opp2000/	Opportunity 2000's Tapping the Talent
http://www.physics.wm.edu/dualcareer.html	Results of the dual career couple survey

Women more generally

http://www.womenlobby.org/html	European Women's Lobby
http://www.ewmd.org	EWMD European Women's Management Development Network
http://www.gn.apc.org/fawcett	Fawcett Society
http://www.cerbertnet.co.uk/ncwgb/	National Council of Women of Great Britain
http://193.128.244.178/wnc/index.htm	WNC; Women's National Commission
http://www.womenconnect.org.uk	Women Connect
http://www.Rocamora.org/WomenTalent.html	Women and Talent
http://www.engr.washington.edu/~wepan/	WEPAN (Women in Engineering Programme Advocates Network – USA)
http://www.awsem.com/index.html	AWSEM (Advocacy for Women in Science, Engineering and Mathematics)

Women's studies

http://www.users.interport.net/~kater/	Artemis: Search For Women's Studies Programs in the US – many links
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Celebration of Women in Science

http://www.agnesscott.edu/lriddle/women/women.htm	Biographies of Women
http://www.physics.ucla.edu/~cwp	Contributions of 20th Century Women to Physics
http://www.swimwithdragons.com.au	Swim with Dragons, Achieve with Science
http://www.sdsc.edu/Publications/ScienceWomen/	Women in Science
http://www.astr.ua.edu/4000ws/4000ws.html	4000 Years of Women in Science
http://www.nae.edu/nae/cwe/cwe.nsf/Homepage	Celebration of women in engineering

Women's units

http://www.set4women.gov.uk	Promoting SET for Women (OST)
http://www.bmbf.de/deutsch/arbeit/index.htm	Women in Education and Research (Germany)
http://www.cordis.lu/improving/src/hp_women.htm	Women in Science Sector, Brussels

Networks

EC Genderwatch and contact addresses in the Member States

Nicole Dewandre, Women and Science Sector, Research Directorate-General, European Commission 200, Rue de la Loi, Brussels B1049

Notes on ETAN network members

Mary Osborn (Committee Chair) (born 1940) has made a career in three countries: the UK, USA and Germany. She is a cell biologist at the Max Planck Institute for Biophysical Chemistry in Göttingen, and is an honorary professor in the medical faculty at the University of Göttingen. Her research interests are in the cytoskeleton and the structure of the nucleus. She was a trustee of the Swedish Foundation MISTRA, has chaired the Scientific Advisory Board of the European Molecular Biology Laboratory in Heidelberg, and is the current chair of the Cell Biology Section of Academia Europaea. She was rapporteur and speaker at the 1993 European Commission Workshop on *Women in Science*, and a keynote speaker at the 1998 EC Conference.

Teresa Rees (Committee Rapporteur) (born 1949) is a social scientist and Professor at the School of Social Sciences at Cardiff University, Wales, UK (previously Professor of Labour Market Studies at the University of Bristol). She specialises in education, training and labour market policies with a special emphasis on mainstreaming gender equality. She is a long-term consultant to the European Commission on mainstreaming and author/co-editor of eight books including *Mainstreaming Equality in the European Union* (1998 Routledge). She is the co-ordinator of a Commission co-funded transnational research project on managing diversity and co-investigator on a research council funded five-country study of adult guidance and the learning society. She is the Equal Opportunities Commissioner for Wales and a past member of the Economic and Social Research Council's Research Grants Board.

Mineke Bosch (born 1954) is an historian of gender and science and associate professor at the Center for Gender and Diversity at the University of Maastricht. She has published a major study on the history of women and science in the Netherlands: *Het geslacht van de wetenschap. Vrouwen en hoger onderwijs in Nederland 1878-1948* (Amsterdam, 1994). From 1996-1998 she co-ordinated the equal opportunities policy of the University of Maastricht, combining her (more theoretical) knowledge of gender and science with the (more practical) policies of women and science. In 1999 she wrote and edited a background study on gender and diversity in science for the National Advisory Council for Science and Technology Policy: *In het hart van de wetenschap. Naar total E-quality en diversiteit in de universiteit*. (Den Haag: SDU, 1999). She was on the advisory board for the Minister of

Education and Science study concerned with the selection mechanisms of the National Organisation of Scientific Research (NWO).

Helga Ebeling, *Dipl. Päd.* (born 1951) is a social scientist. She is the head of the 'Women in Education and Research' division in the Federal Ministry of Education and Research in Germany. She is responsible for national strategies to mainstream gender equality in education and science policy. She has also developed special activities in information technology and business start-ups by women. She is former national co-ordinator of the EU initiative NOW and the IRIS network. She is the chairwoman of a working group 'promoting women in science' of the Bund-Länder Commission for Educational Planning and Research Promotion, which prepared several national reports on women and science. She is the author of numerous publications on women and science, and women and technology.

Claudine Hermann (born 1945) is Professor of Physics at *Ecole Polytechnique*, the most renowned French engineering school. Her research domain is optics of solids. She is alumna of *Ecole Normale Supérieure de Jeunes Filles* and her PhD is in solid state physics. She was the first woman ever appointed Professor at *Ecole Polytechnique* (1992). Since then, in parallel with her activities in physics, she has been studying the situation of women scientists in Western Europe and promoting science for girls, by papers and conferences, in France and abroad. She usually works in a team with Huguette Delavault, a Mathematics Professor in Paris.

Jytte Hilden (born in the 1940s) was educated as a chemical engineer and has been a schoolteacher in chemistry, physics and the sciences for much of her career. She is also a politician and belongs to the Social Democrat Party. She was a member of the Danish parliament for 16 years and was first Minister for Culture and later, Minister for Research and Information Technology. She is concerned with gender issues and has been fighting for women's rights and gender equality all her life. While in office, she produced the report *Women and Excellence in Science*, known as Hilden's 11-point Action Plan. She is currently head of cultural activities at the Royal Library in Copenhagen.

Anne McLaren (born 1927) has been employed as a research scientist by the Agricultural Research Council and the Medical Research Council, and is now working at the Wellcome/Cancer Research Campaign Institute of Cancer and Developmental Biology at the University of Cambridge. Her research has centred on genetics, developmental biology and reproductive biology. She has been Foreign Secretary of the Royal Society, the UK Academy of Science (the first woman officer). She was a member of the Committee on Women in Science, Engineering and Technology that was responsible for publishing the UK report *The Rising Tide* in 1994. She is President of the Association for Women in Science and Engineering (AWISE).

Rossella Palomba (born 1947) is a social demographer. She is Director of research at the National Research Council and Head of the Department on Family and Society at the National Institute for Population Research in Rome. Her main fields of interest are related to the analysis of the changes in the family structure and behaviour, couple formation and dissolution, fertility and gender roles. She chaired two European networks: a) on Population Policies, under the auspices of UN-ECE, and b) on Population

Education, under the auspices of UNESCO. She was a member of the Italian National Committee on Economics, Statistics and Sociology and of the Italian National Committee on the Environment. She is chairing the Commission for the Valorisation of Women in Science at the National Research Council. She has written books and articles on the situation of women in the Italian research system.

Leena Peltonen (born 1952) is currently Chair of Human Genetics at UCLA School of Medicine and also Professor of Medical Genetics in the University of Helsinki and National Public Health Institute, Finland. Her research is targeted into disease genes and molecular biology of human diseases. Using special population resources of Finland, she has identified numerous disease genes and analysed the molecular pathogenesis of human neurological diseases. She has received several international prizes and awards and she is a Member of Academia Europaea, and the European Molecular Biology Organisation. She served as a Chairman of Medical Research Council of the Academy of Finland 1995–1997 and as a Chairman of the European Medical Research Council in 1996–1998. She is a Member of the International Council of HUGO, the EURESCO Scientific Steering Committee and International Bioethics Committee of UNESCO. In 1996–1998 she chaired a working group of the Academy of Finland which evaluated the academic career opportunities for women and proposed actions to eliminate the observed obstacles.

Carmen Vela (born 1955) is manager director at INGENASA, a small company based in Madrid. She is a biochemist by training with seventeen years of research experience and actively involved in several research projects in immunology and virology. She is the author of several patents granted in the USA and Europe. She is an expert evaluator from the small and medium sized enterprise industry border on Biotechnology in national and European programmes and organisations. She was a member of the second European Science and Technology Assembly (ESTA) from 1997–1998.

Dominique Weis (born 1957) has made a scientific career in three countries: Belgium, US and France. She is an Earth scientist, specialising in isotope geochemistry with an impressive publication record (over 70 papers published and more than 150 communications at scientific meetings). Since 1998, she has a position as Directeur de Recherches with the Belgium FNRS (*Fonds National de la Recherche Scientifique*) and has recently been a Visiting Professor at Paris VII University and a Visiting Fellow at the Carnegie Institution of Washington. She is a Council member of the European Union of Geosciences, and a Life and Environmental Standing Committee member of the ESF. In 1992, she was the first woman to be awarded the Prix Alumni (national young scientist award). She was a speaker at the 1998 European Commission conference on *Women in Science*.

Agnes Wold (born 1955) is a microbiologist and immunologist (MD, PhD) and associate Professor at the Dept. of Clinical Immunology, Göteborg University, Sweden. She defended her doctoral thesis in 1989 and spent one year as a post-doc in Chapel Hill, North Carolina in 1991. Her field of interest is the normal intestinal microflora and its interaction with the mucosal immune system. She is a member of the Karolinska Institute board of directors. Together with Christine Wennerås, she published a study of the evaluation of male and female applicants for postdoctoral positions at the Swedish MRC, entitled 'Nepotism and sexism in peer-review', *Nature*, May, 1997.

Alternates

Joan Mason (born 1923) is a chemist. After attending Cambridge University she did post-docs at the University of Southern California, Ohio State University, and University College London. She then encountered discrimination and dropped out for eight years (and 3 children), eventually returning to chemistry at the University of East Anglia. Appointed to the Open University in 1970, she contributed to many courses in science (and women's studies) receiving the ScD (Cantab) and a readership for her research. She edited and partly wrote *Multinuclear NMR* (New York: Plenum 1987). She has written extensively on women in science, historical studies and current issues. She was secretary of the UK Office for Science and Technology working group that produced *The Rising Tide*. This led to the founding of the Association for Women in Science and Engineering, which she chairs.

Christine Wénnerås MD, PhD (born 1963) is an assistant professor at the Department of Medical Microbiology and Immunology, Göteborg University, Sweden. She defended her doctoral thesis in 1993 and spent two years as a post-doc at the Pasteur Institute, Paris in 1996/7. Her fields of interest are diarrheal pathogens (toxigenic *E. coli* and *Shigella*) and their interaction with the innate immune system and enteric nervous system. Together with Agnes Wold she published a study of the evaluation of male and female applicants for postdoctoral positions at the Swedish MRC, entitled 'Nepotism and sexism in peer-review', *Nature*, May, 1997

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Abbreviations

AFFI	Association of French Women Engineers
AKFiZ	Arbeitskreis: Frauen in den Forschungsbereichen (Ger)
ALLEA	All European Academies
AWIS	Association for Women in Science (US)
AWISE	Association for Women in Science and Engineering (UK)
BLK	Federal State Commission for Educational Planning and Research Promotion (Germany)
BMBF	Federal Ministry for Education and Research (Germany)
BuKoF	Network of Equality Commissioners in Higher Education (Germany)
BIOAC	Biological Sciences Advisory Committee (NSF)
BOE	Biological, Oceanographic and Earth Sciences
CEA	Atomic Energy Commission (France)
CEC	Commission of the European Communities
CERN	The European Laboratory for Particle Physics
CNISF	National Council of French Engineers and Scientists
CNR	Consiglio Nazionale della Ricerche (Italian Research Council)
CNRS	Centre National de la Recherche Scientifique (National Centre for Scientific Research) (France)
CODEST	Committee for the Development of Science and Technology
CRAF	Committee on Radio Astronomy Frequencies
CRE	European Rectors' Conference
CREST	Scientific and Technical Research Committee
DFG	Deutsche Forschungsgemeinschaft (German Research Association)
DDR	former German Democratic Republic
DG	Directorate General (of the EC)
DM	DeutscheMark
EARMA	European Association of Research Managers and Administrators

EC	European Commission
EIRMA	European Industrial Research Managers' Association
EMaPS	European Marine and Polar Science
EMBO	European Molecular Biology Organisation
EMBL	European Molecular Biology Laboratory
EMRC	European Medical Research Council
ERT	European Round Table
ESA	European Space Agency
ESF	European Science Foundation
ESF	European Social Fund
ESO	European Southern Observatory
ESRF	European Synchrotron Radiation facility
ESSC	European Space Science Committee
ESTA	European Science and Technology Assembly
ETAN	European Technology Assessment Network
EO	Equal opportunities
EU	European Union
EURO-CASE	European Council of Applied Science and Engineering
EURESCO	European Research Conferences
FEBS	Federation of European Biochemical Societies
FNRS	Fonds National de la Recherche Scientifique
FRG	Federal Republic of Germany
HCM	Human Capital Mobility
HESA	Higher Education Statistics Agency (UK)
HFSP	Human Frontier Science Programme
HGF	The Helmholtz Association of National Research Centres (Germany)
HRST	Human Resources in Science and Technology
HSP II/III	Special University Programmes of the Federal Government and States (Germany)
IBNC	Institute for Molecular Pathology (Portugal)
IFU	International Women's University on Technology and Culture at Expo 2000 (Germany)
INSERM	National Institute of Health and Medical Research (France)
IRDAC	Industrial Research and Development Advisory Committee
ITQB	Institute for Biotechnology (Portugal)
KNAW	Dutch Royal Academy of Arts and Sciences
LESC	Life and environment sciences
MPG	Max-Planck-Society (Germany)

MEP	Member of European Parliament
MIT	Massachusetts Institute of Technology
MRC	Medical Research Council
NASA	National Aeronautics and Space Administration (US)
NWO	Dutch Organisation for Scientific Research
NSERC	National Science and Engineering Research Council (Canada)
NSF	National Science Foundation
NuPECC	Nuclear Physics European Collaborative Committee
PESC	Physical and engineering sciences
POWRe	Professional Opportunities for Women in Research and Education (US)
SCH	Humanities
SCSS	Social sciences
SET	Science, Engineering and Technology
S/T	Science/Technology
TMR	Training and Mobility of Researchers
TSER	Targeted Socio-Economic Research (Framework Programme)
TSME	Technology, Stimulatia and Measures for Small and Medium Size Enterprises
UCLA	University of California Los Angeles
UK	United Kingdom
UN	United Nations
UNESCO	United Nations Educational, Scientific and Cultural Organisation
US	United States
WGL	Association of Gottfried Wilhelm Leibniz Institutes
WISE	Women into Science and Engineering (UK)
WISE	Women's International Studies Europe

Appendix I

Issues and recommendations from previous reports on women and science

I EU LEVEL

Logue, H.A. and Talapessy, L.M (eds) *Women in Science – International Workshop 15th and 16th Feb 1993 Brussels, DGXII*
Commission of the European Communities.

Summary

Participants in this small meeting came from Member States, the Commission and the European Parliament. Political arithmetic exercises show women to be poorly represented in science at all levels in all Member States (although there are variations among them). There are very few women at the top. Key points to emerge:

- women do not have good access to decision-making and research funding in science;
- inflexibility in career structures and child-care issues are part of the problem; and
- there is a need for positive action and for integration of equal opportunities policies in science and technology.

Recommendations (in abbreviated form)

- 1 Qualified women should be included on all committees that set policy and control funds, including IRDAC, CODEST, and CREST, selection committees and national committees.
- 2 The Commission should collect and compare statistical data from EU programmes and Member States of relevance to women in science and

technology (S/T). Data should include:

- a gender breakdown of academic status in universities (overall and for individual S/T disciplines);
- a gender breakdown of staff in S/T research institutes;
- funding by major national granting agencies in S/T research (% female applicants compared with % female scientists that are funded), and
- a gender breakdown of membership of major national S/T policy and funding committees.

- 3 The Commission should take the initiative in developing positive action programmes for women in S/T research. Short-term, appropriate goals should be set for countries and disciplines. Goals should use as a guide the percentage of women occupying positions at the next lowest level.
- 4 Resources from the EC Structural Funds and Social Fund should be used to support women in science and technology.
- 5 Future EC Programmes as well as the Fourth Framework Programme should be used to promote equal opportunities for women in S/T research.
- 6 The Task Force for Human Resources, Education, Training and Youth (now DGXXII) and DGXII should strengthen their commitment to improve the situation of women in S/T research by
 - funding networks (specifically for women in science or technology both in the EC as well as in individual Member States);
 - supporting WITEC, and
 - supporting Women's Studies in science and technology.
- 7 The EC and the European Parliament should monitor programmes for women in S/T research and suggests that:
 - an individual within the Commission should co-ordinate measures designed to advance equal opportunities for women in S/T research;
 - the Commission should establish an *ad hoc* working group concerned with this problem;
 - measures that are implemented should be monitored annually.
- 8 Finally, the workshop urged both the EC and the European Parliament that if sufficient progress cannot be made using persuasion and the measures suggested above, that further legal or financial pressures should be used to enforce the process. A very effective measure would be to require that all industrial firms and academic institutions set up and document programmes to increase the representation of women in S/T research at all levels, as a condition for receiving EC S/T Funds. Reference was made to the 1964 *Civil Rights Act* in the US in this regard.

Response: the report was discussed with Prof. Paola Fasella, the head of DGXII at the time. There was no official response from the Commission to the recommendations. However, the report was distributed throughout Europe and thus the recommendations were widely circulated.

European Commission (1999) *Women and Science: Report of a conference held in April 1998 Brussels: Commission of the European Communities*

This was a larger meeting with more than 200 participants from the Member States, the Commission and the European Parliament, organised by Nicole Dewandre. The format of this meeting was different from the 1993 meeting and therefore it did not result in formal recommendations. One contribution to the conference examined what progress had been made with regard to the recommendations of the 1993 conference: 'Facts and Figures still show little room at the top for women in science in most EU countries' (Osborn, 1999). Other specific recommendations, drawn from contributions to the conference, included:

i) *Education*

- better careers advice in schools;
- encourage work experience in labs for students;
- teacher training to include training in EO;
- and careers advisers.

ii) *Employment*

- employers should establish good childcare, have active EO policies and family-friendly policies;
- mentoring programmes;
- returner schemes;
- chronological age should be replaced by academic age;
- flexible fellowships;
- statistical monitoring;
- data bases;
- address issue of time in balancing families with scientific careers.

2 MEMBER STATE LEVEL

2.1 *United Kingdom*

Committee on Women in Science, Engineering and Technology (1994) **The Rising Tide: A Report on Women in Science, Engineering and Technology London: HMSO (UK)**

The UK Government took note of the women and science question in a review of science policy, the first for 20 years, entitled *Realising our Potential: A Strategy for Science, Engineering and Technology* (Chancellor of the Duchy of Lancaster 1993). During the consultation process, many women voiced the difficulties they encountered, including lack of childcare facilities or scope for flexible-working, and limited job opportunities. The report noted:

- ‘the widespread waste of talent and training, throughout industry and academia, due to the absence of women’,
- that ‘women are the country’s biggest single most under-valued and therefore under-used human resource’,
- that ‘there is massive scope to attract more women into science and engineering’, and
- that the Government had set up an independent working party to address this important issue.

The follow-up report was entitled *The Rising Tide, A Report on Women in Science, Engineering and Technology* (Committee on Women in Science, Engineering and Technology 1994). It documented the loss of girls and women to science at every stage – from choosing science at school, to first degree, then higher degree, and then in the job market, particularly when family responsibilities arose. Few women survive in their chosen profession to reach positions of seniority and influence, even in biology, where women comprise nearly 60% of students; and many continue in work that under-uses their training and talents.

Summary

- 1 Women are under-used in science, engineering and technology (SET). Given the demographic situation (fewer young people, more women in the labour market), the costs of training scientists and engineers and the advantages of diversity, it is vital to attract more women into SET and to retain them. There are three areas of concern: education and training, employment and women at the top.
- 2 *Education and training*: the number of applicants of both sexes for science and engineering in higher education is lower than for humanities and arts: how can we encourage more women into SET at school, college and university?
- 3 *Employment*: how can careers in SET be made more accessible to women, especially during the child-bearing years?
- 4 *Women at the top*: how can it be ensured that more women are represented on and chair boards and bodies responsible for developing and managing SET?

Recommendations

i) Education

- a Development Unit should be established to take forward recommendations;
- teacher training should include EO on the curriculum including guidance on maintaining the interest of girls and boys in science subjects;
- the school curriculum should be broad enough to encourage more young people, particularly girls, to study science beyond 16.

ii) Employment

- EO policies should be part of an organisation’s strategy and be reported on in annual reports;
- organisations should build upon initiatives like *Investors in People* and *Opportunity 2000* to address the specific needs of women in SET;

- pilot studies should identify and disseminate information on economic and other benefits of women-friendly management practices in SET;
- the Government should provide more child-care services and help with costs and facilitate support for Returner schemes for women in SET;
- funding for research staff should be more flexible to accommodate family commitments; and
- regional careers development advisory services for SET should be set up.

iii) *Women at the Top*

- the Office of Science and Technology (OST), employers and professional associations should maintain databases and networks of qualified women scientists and engineers for selection for boards, committees and public appointments;
- Government Departments and employers should set targets of at least 25% women in public appointments and senior positions in SET by 2000;
- the OST should further develop its strategy for promoting awareness and encouraging media coverage of women's contribution to SET.

The Government's response, *Making the Most: Women in Science, Engineering and Technology* (DTI, OST & Opportunity 2000 1994) accepted these recommendations, except the call for income tax relief for costs of childcare (there is tax relief for employers funding childcare). A women's unit was set up within the OST, which is now called *Promoting SET for Women*.

The *Rising Tide* target of at least 25% women in public appointments and senior positions in SET by 2000 will not be met. There are many reasons for this. Science is competitive, there is a long-hours culture, and women develop family responsibilities at the time when a male scientist is consolidating his career base. Frequently a man's career takes precedence over his partner's because he is likely to earn more money, and as a result, he does earn more... a circular process. Fixed-term (or short-term) contracts, so prevalent in scientific research, impact severely on women, particularly those with family responsibilities. Women who work part-time or take a career break for family reasons face competition when they try to return, from a rising generation which is freshly trained, and cheaper.

2.2 Denmark

Ministry of Research and Information Technology (1998) Women and Excellence in Research Copenhagen: Statens Information

At the time this plan was developed, Jytte Hilden was Minister of Research and Information Technology in Denmark. Hilden's 11-point action plan was developed after a series of conferences held in Danish universities:

- 1 Equal opportunities (EO) – a management responsibility (the obligation to promote EO in research should be made statutory).
- 2 More female professors (40 professorships should be reserved for the 'under-represented sex');
- 3 Awareness in job advertising.
- 4 Gender-neutral selection committees.
- 5 Tutoring and mentoring.

- 6 Annual progress reports on EO in research.
- 7 Higher priority on gender research.
- 8 Government research institute on EO.
- 9 Child-rearing allowance for young women and men.
- 10 Family and career balance.
- 11 EO in all walks of life.

The report was debated in the Danish Parliament on 11 February 1999. The new Minister stressed that equality is a management responsibility and that the new Executive Order on university appointments (from September 1998) places responsibility for appointments with the management. Questions of equality can be taken into account as one of the appointment parameters. He spoke out for family-friendly environments and for mentoring systems. Finally, he instructed all universities and research institutions to present plans of action for equality and to prepare an annual report on the distribution of scientific personnel by gender.

Leading up to the Parliamentary debate, a heated discussion took place in the Danish press on the allocation of funds for the 40 extra professorships. The media debate illustrated that opinions among both politicians and researchers differ significantly with regard to the application of positive discrimination in order to achieve equality. Although there is growing awareness that the achievement of equality calls for special initiatives, including the setting of new priorities in the policy governing the appointment of professors, the debate showed that public opinion is still very much divided on the issue of special professorships for women. Although the Minister was prepared to allocate funds for the establishment of these posts, the majority of politicians were against it on the grounds that men and women should compete on equal terms and that the earmarking of special funds for 'women professorships' would undermine research quality. The issue of more female professors will now be included in negotiations between the Ministry of Education and the Ministry of Research on the creation of more permanent research positions in Danish universities, including professorships.

Attention is also drawn to the FREJA Initiative that provides research grants preferentially given to women (discussed in Chapter 3).

2.3 Finland

Working Group appointed by the Academy of Finland (1998) Women in Academia, Publications of the Academy of Finland 3/98, Helsinki: Edita

The Working Group was set up to investigate career opportunities for women and ways of eliminating obstacles, investigate impact of hidden discrimination in the academic community and propose a development plan for the Academy of Finland.

Summary

- During the last 10 years, the share of women getting doctoral degrees has increased rapidly reaching the 40% level at the end of the 1990s. However, the immediate post doctoral period appears to be particularly

problematic for women, and women are still underrepresented at higher levels of the academic hierarchy. The more teaching a post involves, the more likely the post is to be occupied by a woman.

- The publicly appointed top level scientific and science policy boards are approaching gender balance, but the decision makers in the private science foundations are predominantly male.
- Grants account for a growing proportion of research funding, especially for young researchers. There are problems related to social security (eg maternity leave compensation) with such grants.
- The growing use of the invitation procedure in professorial appointments has in practice proved to be a mechanism that discriminates against women. Research institutes are also often recruiting researchers by invitation.

Recommendations were divided into 4 areas:

1) Evaluation methods:

- Peer review should focus more on research plans and not simply on past achievements.
- The number of women on boards and decision-making bodies of foundations, scientific organisations and research institutes should be increased.
- The Academy of Finland and the universities should operate the 40-60 rule, whereby at least 40% of experts on any committee should be women.
- Greater attention must be paid to gender equality in recruitment policies and practices in research institutes and universities.
- The Academy of Finland should set up a programme for developing the national evaluation of research.

2) Allocation of Research Funds by the Academy of Finland

- The Academy of Finland must check and critically assess that equality is achieved between men and women in the centres of excellence and other units receiving special funding.
- The Academy of Finland must oblige Research Councils to take a stand on the development of women's research careers.
- Three *Minna Canth* Professorships should be established for gender studies.

3) Improving the status of junior researchers and researcher families

- Researchers whose salaries are funded by grants should be eligible for normal social security, sick pay, maternity leave arrangements etc.
- Childcare and home care services should be flexible and child minders wages tax deductible.

4) Attitude Education

- Some educational science resources should be channelled into research into equality education.

- Special attention should be paid in the teaching of mathematics and information technology to encouraging girls.
- The image of science and its gender orientation in the media should be considered in the Academy's media research programme
- The Academy of Finland should monitor the position of women in academia.

Response. In 1998 the Academy of Finland set up working groups to follow up the development of women's academic career and development of gender equality in academia. The main principle is to mainstream gender equality into all science policy and research funding. The first comprehensive gender equality plan of the Academy of Finland will be launched in the year 2000.

2.4 Germany

The German Reports and Programmes

Legal framework

The German Basic Law stipulates: 'The state shall promote the actual implementation of equal rights for women and men and takes steps to eliminate disadvantages that now exist.' The amendment to the *Higher Education Framework Act* in 1998:

- mentions the universities' women's affairs and equal rights commissioners;
- introduces an evaluation and performance-oriented funding of universities. The appropriation of government funds will be geared to universities' performance in teaching and research, their support for young scientists and the enforcement of gender equality;
- Habilitation is no longer the standard criterion in the appointment of professors.

Reports of the Bund-Länder-Kommission (Bund-Länder Commission for Educational Planning and Research Promotion)

Bund-Länder-Kommission für Bildungsplanung und Forschungsförderung, The First National Report on the 'Promotion of Women in Science', 1989

This report recommended:

- the appointment of equal opportunity commissioners at all universities and research institutions on a legal basis;
- better consideration of female biographies in the job placement procedures;
- development of equal opportunity plans and regular reporting;
- establishing job placement programmes for women scientists;
- compensation for disadvantages due to child-care;
- introduction of flexible working hours;
- easy handling of leave of absence for family reasons; and
- the promotion of research on women.

The report also provides a basis for annual gender-disaggregated statistics and a specified reporting system.

The First Update of the National Report on the 'Promotion of Women in Science', 1996

This revealed improvements in individual areas, for example, in the establishment of equal rights structures at universities, in legislation improving the opportunities for reconciling a scientific career and child-care and in the development of research on women. But the insufficient participation of women, particularly in leadership positions, in research institutions and in research support remained a cause for concern and became the subject of intensive discussions at the highest government level. A comparison of the old and new German States showed that women in the new States were withdrawing in significant numbers from science and scientific and technical study courses. The Bund-Länder Commission was requested to refine and update the statistics, make comparative analyses of the old and the new States and to collect data on current appointments to leadership positions on an annual basis. At the same time, the German Research Association (DFG) was called upon to report annually on the implementation of the measures concerning equal opportunities for women in science.

Supplementary Report on the 'Promotion of Women in Science', 1997 Second update

A six-point programme was adopted (Beschuß der Regierungschefs des Bundes und der Länder):

- Promotion of women is a task for the principals or governing boards of universities and the directors or boards of research institutions;
- Promotion of women must therefore be an integral part of all academic and research policy measures;
- Universities and research institutions are role models for other areas of society and they must raise awareness of the issue;
- Clear signals are required to highlight the need for an initiative to make equal rights for women in science and research a reality;
- The qualification potential of women is to be developed to a greater extent and used systematically in leadership positions;
- When filling leadership positions in universities and research institutions, the aim must be to increase the number of women considerably (The goal set by BMBF was 20% by the year 2005).

Furthermore annual reports were to be submitted on the progress achieved with regard to the share of women in leadership positions

First and Second National Report on 'Women in Leadership Positions', 1998 and 1999

These were the first reports to include data on current appointments. They showed that women received more than 15 % of the actual appointments (C3 and C4 levels together). They drew attention to the fact that the research institutions have much lower numbers of women in top positions

than do the universities (see Fig.2.1). A meeting in 1998 stressed the necessity of providing childcare for female scientists with children.

3 Recommendations of the German Council of Science (Wissenschaftsrat) on 'Equality for Women in Science and Research', 1998:

- Men and women should have the same rights to financial support, encouragement and mentoring at all stages of their academic careers.
- The diversity of life planning patterns of women and men should be compatible with careers in science and research.
- The States and the local communities should give priority to building up adequate childcare services. Universities and research organisations should also provide such services.
- The realisation of equality for women in science and research is a strategic task for every higher education and research institution. Equality plans with concrete targets to raise the proportion of women at each level must be developed. Incentives to ensure that this is done should be reflected in the budgets of the institutions.
- Study plans and final exams should be more flexible to take into account the diversity of life planning patterns, expectations and career wishes. Part time study should be available to students with children or other family responsibilities.
- In all disciplines, a lower proportion of women than men complete the Ph.D, and an even lower proportion habilitate. One way to change this is to ensure that the proportion of women receiving stipends and starting jobs at universities and research institutions should be at least equivalent to the proportion of women who graduate from the university. At subsequent levels, including those of professor, the proportion that obtains the Ph.D in that field should be used as a guideline. Special programmes for women in science will be necessary as long as female scientists are discriminated against. In disciplines in which women are particularly poorly represented, female candidates have to be given priority so that change can occur rapidly.
- All obstacles of a structural nature that hinder women from acquiring the necessary qualifications for a professor position should be abolished.
- Appointment procedures have to be gender-neutral. Selection criteria that may refer to higher age of applicants or to career pauses do for instance discriminate, at least indirectly, against women. The number of women in promotion commissions should be increased significantly.
- Curricula that prepare individuals for professorial positions at the technical institutions, known as '*Fachhochschule*', should be made more attractive for women.
- Transparency and competition among universities should be encouraged during the academic qualification process. Future reforms should ensure that adequate employment status, albeit on temporary positions, can be offered during the different qualification stages.
- All jobs that can be used to qualify for an academic career should be advertised. They should be filled by competition following guidelines developed and published for each post.
- Universities must provide long term perspectives for outstanding young scientists in order to strengthen science and research. Increasing both the numbers of jobs, as well as the length of time these jobs can be held, should increase the attractiveness of scientific careers for women.

HSP II and III funding programmes in support of higher education and research

The HSPII Programme was originally meant to run from 1990 to 2000. It has been replaced by HSPIII for the years 1996–2000. The aim was to design promotion procedures (in particular doctoral studies and habilitation) to suit women's needs, to provide systematic information and to develop specific measures for women scientists (such as those promoting re-entry). This was in order to increase the proportion of women over the various levels of qualification continuously, starting out from the number of women graduates, which was about 40% at that time. In this way, the special funding programme was to contribute to ensuring a sufficiently large number of women candidates for chairs that will become vacant at the end of the 1990s. The programme provided performance-related parameters for the first time. It was designed to achieve a dynamic increase in the proportion of women appointed in line with the proportion in the previous level of qualification. It also involved the general abandoning of age limits, the introduction of flexible working hours (i.e. part-time contracts, including the possibility of extension), child-care supplements to fellowships, measures supporting the re-entry of women into science after a family phase and contact fellowships granted, for example, to women on parental leave.

The special funding programme, launched by the Federal Government and the Länder in 1990, had an initial budget of DM 4 billion for the period until the year 2000. A special programme for the new Länder was added in 1993. Three years later, the programmes for the old and the new Länder were combined (HSP III) and funding was again increased. Thus for the period 1996–2000, 3.6 billion DM were provided by the Federal Government and by the individual states. The HSP II/III Programme has so far been the most important mainstreaming programme to implement equality of opportunity in science. It has contributed to a marked increase in women's participation in doctoral studies and habilitation procedures. Initial effects on appointments can now be seen. In 1998, for example, more than 10,000 women scientists received funding under the programme. In 1998, over 210 million DM were provided for women in science although originally only 144 million DM had been allocated in their budget.

A new programme – *Programme to support equal chances for women in Research and Education* will be introduced from the year 2000 with a budget of 60 million DM. Its goals are to increase the number of women in top positions, to remove the structural barriers that prevent women from making an academic career and also to increase the number of women scientists at lower levels. The budget will be divided so that 75% of the funds go to support women scientists trying to obtain the necessary qualifications for an academic career, 15% to gender studies and 10% to strengthen women's participation in natural sciences and technical subjects. This programme, together with other measures supported by the Federal Government including the Emmy Noether Programme, mean that the amount of money earmarked to support women in science in 2001 will exceed that available in 1998.

5 International Commission on the German Research Association and the Max Planck Society

An international commission charged with investigating the DFG and the Max Planck Society, recommended the removal of structural barriers to the appointment of women to top positions in the universities and research institutes. Their report *Forschungsförderung in Deutschland* (1999) recommends introducing more flexibility into the system by providing ‘assistant professor’ and ‘tenure-track’ positions.

6 Conclusions

The implementation of equal opportunities for women in science is a very complex long-term project. Experience has shown that progress can only be made if various activities are meshed together. These should include reporting systems, continuous information and awareness-raising up to the highest government level, equality of opportunity as a management task, legal framework, structural changes, improvement of overall conditions, establishment of equal rights structures in the institutions, supra-regional networks and supporting measures. The central points in the implementation of equal opportunities in Germany are:

- increasing the share of women in leadership positions;
 - promotion of young scientists;
 - finding an alternative to habilitation.
-

Appendix II

Women and science: Networking the networks

Brussels – July 8th & 9th, 1999

Declaration of Networks Active in Europe

We:

- the representatives of networks of women scientists and organisations committed to the improvement of the gender balance in research policy;
- present at a meeting in Brussels on July 8 and 9, 1999;

Welcome the initiatives being taken on women and science by DGXII.

State that:

- The gender balance in research policy is to be perceived from three different perspectives: research *by*, *for* and *about* women. Progress has to be made in these three perspectives, i.e. (i) promote women's participation in research activities, (ii) ensure that women's needs and interests are taken into consideration when setting research agenda, (iii) promote the understanding and the inclusion of the gender issue.
- The under-representation of women in science and decision making bodies is both wasteful of human resources and a serious obstacle for the development of the sciences and for European society as a whole.
- Scientific development leads to new frontiers for human responsibility and implies increasingly fundamental ethical choices. This also calls for the need for an improved gender balance in the field of research.
- Networking among women scientists is essential to empower women scientists in their respective fields.

Recognise that:

The *rationale* for the networking of women scientists is:

- To support, enhance and empower *members* in their careers;
- To inform, encourage and motivate *girls and young women* to choose scientific subjects; to campaign to make scientific careers more attractive;

- To provide a database of *role models and mentors* for individuals and organisations that require them;
- To take part in *decision-making processes* to contribute to the shaping of scientific institutions and their culture;
- To encourage *employers* of scientists to ensure that women have access to, can return to and progress in scientific careers; to campaign for family-friendly measures to be incorporated into fellowships and mobility scholarships and for special projects in each Member State to facilitate women's return to scientific careers;
- To lobby and take part in *policy processes* in order to improve the gender balance in research and research policy as well as the position of women in science and science policy.

The networks and organisations committed to the improvement of the gender balance in research policy use **different tools** for communicating, informing and lobbying. They recognise, however, the importance of Internet-based tools and new technologies in that they make the networking of networks easier and cheaper and facilitate the achievement of networks' objectives. Databases, newsletters and other conventional means are useful tools especially at the local and national levels. Tools for public outreach and regular and permanent contacts with journalists are also relevant. Networks should consider themselves resources for the media. It is important to develop benchmarking systems as well as auditing systems on gender balance in the various institutions.

To improve the gender balance in research, the reasons for the actual imbalance must be researched and analysed. **Gender research** on all aspects of science (the contents, the methods and the processes) is crucial to produce change. The exchange of knowledge between the different networks of gender research specialists, women scientists, and equal opportunities policy makers is important to identify efficient ways of solving the main problems in the area of women, gender and science. It is also important for networks of women scientists to establish links and partnership with the main networks of scientists in the same field.

The **European added-value** is linked to all aspects of the rationale for networking. It provides value to the members by bringing more women scientists into the Fifth Framework Programme thus not only enriching the research but also giving visibility to the research done by women scientists. In addition, women scientists will benefit from the European scale in their research activities. On the policy side, the European added value is three-fold: (i) it strengthens each network by allowing an exchange of experiences and good practice; (ii) it facilitates co-operation and consultation across sciences, between women scientists and networks, which will allow for a greater participation in the European Union policy process and public debate; (iii) it encourages the development of European evaluation tools in order to monitor the impact of current policies at both national and European level on women in science.

Recommend

The development of tools by the networks:

- **Awareness and educational tools:** EU and Member States should support the development of expert databases of women scientists and commission

research on the databases held by networks on women in science.

- **Communication tools:** EU and Member States should support, fund and provide training – if needed– for the development and use of the Internet and new technologies for the dissemination of information and communication with and between networks as well as improve the use of traditional means of disseminating information and communication.
- **Lobbying and advocacy:** Information kits on FP5 and the importance of women in science should be provided by the Commission and each network could add its material too. These kits would be disseminated to local and national political representatives. A mechanism that would encourage local visits by women scientists to their political representatives should also be developed. This could be done at the national and European level.
- **Measurement tools:** EU and Member States should provide and facilitate the benchmarking of networks organisations.
- **Tools to better network the networks:** EU and Member States, which use networks on a professional basis for advice, expertise and dissemination of information, should recognise and formally support the networks, as well as the establishment of national nodes of existing networks.

The promotion of the link between gender research and the “women and science” issue:

- The networks should promote discussion on the definitions of science and scientific quality.
- The need for expert knowledge on questions of women, gender and science should be inventorised.
- The issues which are raised in the inventory should be implemented in the next framework and, where possible, in the remaining part of FP5 ; this means that there should be a dual approach to gender research: mainstreaming and specific attention to gender research programs.
- Journals of women scientists and gender research should be inventorised in order to provide a common platform; the scientific journals among these should be recognised as such.

The creation of a European network of networks on women and science:

- The European network of networks on women and science should regroup existing networks of women scientists and organisations committed to the improvement of the gender balance in research policy from the European Union and from Eastern and Central Europe.
- Such a network would exchange information in particular on European and national legislation and programmes and would also give visibility to the opinions of women scientists on all areas related to women in science. It would also exchange experiences and strategies on a regular basis. The creation of this network should be facilitated by the existing networks themselves by including a European dimension in their work and consultation.
- The creation and maintenance of such a network should be supported on a long-term basis by the European Union, in particular through enabling women scientists to meet on a regular basis and allocating resources for the maintenance of such a network.

Finally

- The European Commission should commission a project which documents best practice in supporting women in science in the Member States (drawing on the networks).
- Institutions employing scientists should produce annual statistics on gender monitoring.

The next European Commission and the new European Parliament should continue to support the serious commitments that have been made to gender and sciences in the Fifth Framework Programme, and help facilitate the creation, maintenance and strengthening of a European network of women scientists.

Appendix III

This appendix provides further information necessary to interpret Table 2.1 on page 10. This table shows the percentage of academic staff at each level that are female for all disciplines combined. Other data in this appendix provides some data for academic staff in the Member States broken down by discipline.

Breakdown of academic staff in Scandinavia

Table III.1: Percentage of women in the professoriat and among academic staff in universities in Denmark, Finland, Norway and Sweden

	Percentage women in the professoriat (1996) (Percentage women among academic staff [1995])							
	Denmark		Finland		Norway		Sweden	
Humanities	10	(33)	28	(47)	18	(36)	18	(43)
Social Sciences	11	(23)	20	(41)	11	(34)	11	(33)
Natural Sciences	1	(19)	8	(27)	7	(21)	5	(26)
Agriculture and Veterinary Medicine	5	(36)	31	(48)	6	(25)	11	(37)
Health Sciences	8	(31)	19	(47)	13	(34)	6	(40)
Technology	2	(13)	5	(17)	2	(12)	4	(17)
Total	7	(24)	17	(36)	10	(29)	8	(33)

Source: Ståhle (1997)

Breakdown of academic staff in other Member States

In France and Italy, data are given for universities and national research institutions – CNRS in France and CNR in Italy. In these countries, the percentage of women in top positions seems higher in the research institutions than in the universities.

The indicator – number of women in the highest position/total number of women in the same discipline – expresses the chance for a women to be promoted. In CNRS, in disciplines such as Chemistry or Life Sciences where women are more numerous, their chances of promotion are smaller than for example Physics. The corresponding indicators for men in these disciplines would be Chemistry 48%, Life Sciences 45%, Physics and mathematics 39%.

The proportion of professors that are female in the Netherlands and the UK is extremely low, even in the Humanities.

Table III.2: Percentage of women among academic staff in universities and research institutes, by discipline and level

France, univ. 97	Law	Literature	Sciences	Health	total
Professeurs	14	27	9	10	14
Maîtres de conf	33	46	29	48	34
P/(P+MdC)	20	37	14	23	22

Source: Ministry of National Education, Research and Technology, Direction of Prospective and Development note 99

F, CNRS, 12/96	Nuclear physics	Physics and mathematics	Engineering sciences	Chemical sciences	Universe sciences	Life sciences	Human and social sciences	Total
Direct recherche	10	14	8	17	17	31	30	21
Chargé recherche	22	23	21	44	30	46	45	37
Dir/total	13	32	17	25	27	30	27	28

Source: CNRS data base

Italy, univ 1994	Bio-medicine	Technology	Arts	Social sciences	Other	Total 97
full professors	10	5	22	8	8	11
Associate professors	24	14	43	23	24	27
Researchers	34	24	60	37	41	
total	25	14	45	24	25	

Source: National Research Council

Italy, CNR 1997	Biology	Technology	Chemistry physics	Mathe-matics	Social sciences	Humanities	Total
Directors	22	15	5	27	46	42	13
Senior	52	20	18	65	43	56	26
Researchers	45	29	33	47	33	72	36
total	44	25	25	44	53	54	30

Source: National Research Council

Netherlands 97	Agriculture	Nature	Technology	Health	Economics	Law	Behaviour and social sciences	Language and cultural sciences	All disciplines 1997
HGL (prof)	7	2	2	5	2	6	8	11	5
UHD (assoc prof)	5	4	2	8	2	18	13	14	8
UD (assist prof)	13	10	7	23	13	38	25	27	
OVWP (oth acad)	31	21	16	43	23	44	44	47	
AIO (grad assist)	44	31	19	57	21	50	59	44	

Source :WOPI 1998 VSNU

UK 1996/7	Medicine and dentistry	Biological sciences	Chemistry	Mathe-matics	IT and Systems sciences	Physics	Engineering and technology	All disciplines
professors	7	6	0	3	8	1	1	9
senior lecturer	19	12	4	7	15	4	4	18
lecturer	33	26	12	18	21	9	10	33
postgraduate	52	52	34	27	24	19	17	45
research only	53	37	15	23	25	8	12	36

from the Higher Education Statistics Agency. Staff involved in teaching and research, all 'wholly university funded'
Includes the staff of the former colleges and polytechnics which became 'new universities' in 1993-4

Sources and notes to Table 2.1, Figure 2.3 and Figure 2.4

The data for this Table took considerable time and effort to compile, highlighting the problem of lack of comparable, harmonised data sets.

Sources

Australia	AVCC, DEETYA
Austria	Ministry for Science and Transport
Belgium	VLIR/CreF Statistical Services (Fl/Fr)
Canada	Royal Society of Canada (Sophie Nina)
Denmark	Ministry of Research and IT (Bertel Ståhle)
Finland	Ministry of Education KOTA base
France	Ministry of Education
Germany	Federal Office for Statistics
Greece	Central Statistics Office
Iceland	Statistics Iceland
Ireland	Higher Education Authority
Israel	Israeli Council of Higher Education
Italy	National Institute for Population Research, Rome
New Zealand	Ministry of Research, Science and Technology
Netherlands	Ministry of Education, Culture and Science
Norway	Statistics Norway
Portugal	Observatorio das Ciências e das Tecnologias
Spain	Mujeres en cifras
Sweden	Statistics Sweden
Switzerland	Federal Office for Statistics
Turkey	State Institute of Statistics, Prime Ministry
UK	HESA
USA	American Association of University Professors

Categories

Australia	A above Senior Lect, B Senior Lect (level c), C Lect (level b)
Austria	A Ord Prof, B Ausserord Prof, C Univ Assistant
Belgium	AGewoon hoogleraar, /Prof ordinaire, B Hoogleraar/Prof, C Hoofddocent/Chargé de Cours (Fl/Fr)
Canada	A Prof
Denmark	A Prof, B Lektor/Dozent (assoc prof), C Adjunkt (Ass Prof)
Finland	A Prof
France	A Prof, B Maitres de conférence
Germany	A C4 Prof, B C3 Prof, C Assistants
Greece	A Full Prof, B Assoc Prof, C Assist Prof
Iceland	A Prof, B Assoc Prof, C Lecturer
Ireland	A Full Prof, B Assoc Prof, C Senior Lecturer
Israel	A Prof, B Assoc Prof, C Senior Lecturer
Italy	A Prof, B Assoc Prof, C Assist Prof
Netherlands	A Prof, B Senior Lecturer, C Lecturer
New Zealand	A Prof, B Reader/Assoc Prof, C Senior Lecturer
Norway	A Prof B Assoc prof, C Assist Prof
Portugal	A Full Prof, B Assoc Prof, C Assist Prof
Spain	A Full Prof, (Catedráticos) B Assoc Prof (Titulares) Asst Prof (Associados)

Sweden	A Prof, B rest of faculty, C lecturer
Switzerland	A Prof (I+II), B Other Dozenten (II-VI), C WM + ASS (VII-X)
Turkey	A Prof, B Assoc Prof, C Assist Prof
UK	A Prof, B Senior Lecturer + Reader, C Lecturer
USA	A Prof, B Assoc Prof, C Assist Prof

Notes:

- Statistics relate to different years, since it takes some countries longer than others to process data for a given year. Data collected between April 1998 and December 1999.
- Some countries – in particular Scandinavia and Turkey – were able to provide data instantly. For some countries, the gender statistics were not collated but were provided on a ‘per university’ basis. Belgium keeps two separate sets of statistics, one for the French (Fr) and one for the Flemish (Fi) community, each with its own categories.
- In Finland the rank of associate Professor was abolished in August 1998. All associate professors were made full professors although salaries currently remain at the associate professor levels.
- In Ireland statistics include the 7 universities and 2 teacher training colleges and National College of Art and Design.
- The figures from Portugal refer only to academic staff performing R. and D activities and do not include those only involved with teaching duties.
- Note that type of institution may be important. For example, numbers given for the US apply only to ‘doctoral level institutions’ (those awarding more than 30 doctorates per year). If comprehensive, general baccalaureate and two year colleges are also included, the percentage of full professors rises to 18.7%, associate professors to 34.6% and assistant professors to 46.8%

Appendix IV

Women at the top levels in industry

There are enormous difficulties in finding good gender disaggregated statistics, data or even general information on this topic. It is essential to provide them at both the Member State and the EU levels so as to be able to measure women's access to all levels of management.

Information compiled by the European Commission on TSME projects (Technology, Stimulation and Measures for small and medium sized enterprises) show that the percentage of proposal directors who are women is around 6%, while the percentage of project partners is around 24%. The percentage of female managers/presidents of Spanish companies taking part in research projects is around 4%.

In 1995, a study of 57 large companies in Germany showed that on the average only 1.2% of managers at the top level were female. It showed further that the percentages were very different for different companies. The percentages of managers that were female (top, middle and lower levels) were as shown in Table A1:

Table IV.1: Women managers in German companies (%)

Company	Top Management	Middle Management	Lower Management
Audi	0	0	23
Volkswagen	0	3	6
Bayer	1	4	11
Siemens	1	4	10
IBM	2	5	6
Hoechst	3	5	7
Lufthansa	4	10	30
Philips	5	12	*
Hewlett-Packard	5	12	*
Unilever	7	10	14

Source: Bischoff 1996, 1999

* indicates no data available

The author of this study, Sonja Bischoff, further states that industry in Germany recruits 30% of its trainees for its management programmes from graduates in economics, 25% from graduates in engineering and 25% from graduates in information technology, mathematics and natural sciences. In 1996, women formed 40% of the economics graduates but only 15% of the engineering graduates and much less in those engineering disciplines sought after by industry – mechanical and electrical engineering. Women also do not form a high proportion of graduates in chemistry and information technology – the science specialities sought after by industry. Thus, to some extent, women are excluded from a later career in industry by the choice of subject studied at the university (Bischoff 1996; 1999)

In 1998, the only National Statistics Office in Europe able to supply a number for the percentage of top managers that were female was the Netherlands. The number was 1.5%

In the US, only 3-5% of the top managers of Fortune 1000 and Fortune 500 companies are female. Women run just three of the companies on the Fortune 500 list.

In Canada, women run two of the three largest companies on Canada's Financial Post 500 list: General Motors Corporation of Canada and Ford Motor Co of Canada. Women run 10 of the largest companies in Canada.

Appendix V

Women in the world's academies of science

This information is not routinely collected, and we thank the Academies which have supplied it on request. Only full members of the Academies are counted, not corresponding or foreign members. Where possible we have listed the numbers of women and the total numbers of fellows in the class of sciences (see footnotes). Under the heading Council we give the numbers of women/total members of the Academy's Council or Executive Committee.

Women are poorly represented in the Academies and improvement is slow, even though some Academies are clearly taking steps to include more women.

Table V.1: Women in the world's academies of science

	founded ^a	1st woman elected	no. of women	total no.	% women	council	year
Austrian Academy of Sciences ^{b,c}	1847		0 0	65 83	0 0	0/4	1994 1999
Royal Belgian Academy of Sciences, Letters and Fine Arts ^{b,c}			2	29	6.9		1999
Belgium: Royal Flemish Academy for Sciences, and Arts ^{b,c}	1772	1975	0	40	0		1999
Royal Danish Academy of Sciences and Letters ^{b,c}	1742	1968	5 5	125 143	4.0 3.5	1/8	1991 1999
Finnish Society of Sciences and Letters ^{b,d}	1838	1960	11	230	4.8		1994
Finnish Academy of Science and Letters ^b	1908		36	445	8		1999
Académie des Sciences, France	1666	1962	4 5	125 139	3.2 3.6		1991 1999
All German Academies of Science ^{b,d,e}	1700-1975	1767	33 56	1315 1378	2.5 4.0	4/46	1991 1999
Greece: Academy of Athens ^{b,c}	1926	1997	0	15	0		1999
Icelandic Society of Sciences ^b	1918	1928	19	155	12.3	1	1999
Royal Irish Academy of Science, Polite Literature and Antiquities	1945		15 18	275 280	5.5 6.4	3/21	1994 1999
Italy: Accademia Nazionale dei Lincei, Rome ^{b,d}	1603	1947	13	496	2.6		1999
Royal Netherlands Academy of Arts and Sciences ^{b,c}	1808	1950	1 1	286 237	0.35 0.4	0/4	1994 1999
Norwegian Academy of Science and Letters ^{b,d}	1857	1911	82	736	11.1		1999
Portugal: Academy of Sciences of Lisbon ^{b,c}	1851	1981	0	23	0		1994
Scotland: Royal Society of Edinburgh ^{b,d}	1783	1949	54	1148	4.5		1999
Royal National Academies of Spain ^{b,d}			9	336	2.7		1999

	founded ^a	1st woman elected	no. of women	total no.	% women	council	year
Royal Swedish Academy of Sciences	1739 1748	1951	13 19	330 347	3.9 5.5		1994 1999
UK: Royal Society of London	1660	1945	31 43	1059 1185	2.9 3.6	1/21 2/21	1990 1999
UK: Royal Academy of Engineering	1975, 1992		13	1117	1.2	1/24	1999
Croatian Academy of Sciences and Arts			9	142	6.3		1999
Estonian Academy of Sciences	1938	1946	1	59	1.7		1999
Hungarian Academy of Sciences	1825		6	183	3.3		1994
Latvian Academy of Sciences	1946	1971	10	86	11.6		1999
Lithuanian Academy of Sciences		1998	1	39	2.6		1999
Polish Academy of Sciences ^b	1952	1952	5	199	2.5	0/4	1994
Russian (formerly USSR) Academy of Sciences	1725, 1925, 1991	1939	4 10	332 600	1.2 1.7		1991 1998
Slovenian Academy of Sciences and Arts	1938		2	68	2.9		1999
Turkish Academy of Sciences			16	110	14.6		1999
National Academy of Sciences of Ukraine	1918	1924	5	192	2.6		1999
Academia Europaea, London ^{b,d}	1988		103	1854	5.6	3/18	1999
European Academy of Arts, Sciences and Humanities, Salzburg ^b			19	892	2.1		1994
Academy III (Science) of the Royal Society of Canada	1882	1946	37 48	835 899	4.4 5.3	4/18	1994 1999
Australian Academy of Science	1954	1956	8 13	280 311	2.9 4.2	1/16	1994 1999
Chinese Academy of Sciences	1949	1955	27	533	5.1		1994
Indian Academy of Sciences	1934	1952	16	631	2.5		1991
Indian National Science Academy	1935		21	679	3.1		1994
Israel Academy of Sciences and Humanities ^b	1959	1990	1 3	32 77	3 3.9	1/5	1990 1999
Japan Academy ^b	1879	1995	1	133	0.8	0	1999
Royal Society of New Zealand	1867, 1933	1936	19	259	7.3		1999
US National Academy of Sciences ^f	1863	1925	73 118	1647 1904	4.4 6.2	3/17 3/17	1990 1999
US National Academy of Engineering			46	1984	2.3		1999
Third World Academy of Sciences	1983	1983	16 20	351 512	4.6 3.9	1/14	1994 1999

^afounded or reorganised ^bincludes science and arts (humanities, letters) ^conly the class of sciences has been counted ^din 1991, head count of 5 regional academies, not including Göttingen and Heidelberg: in 1999, head count of the 7 regional academies ^eincludes foreign and corresponding members ^factive + emeritus; membership includes social sciences (see also Mason, J. 1991, 1995).

Appendix VI

Women and international and national prizes

(see also details of Nobel prizes in chapter 2)

I) International prizes

The Crafoord Prize, Sweden

Awarded by the Royal Swedish Academy of Sciences and established in 1980, the prize is to promote basic research in mathematics, astronomy, the biosciences (particularly ecology), the geosciences and polyarthritis. \$500,000 prize. 0/31 female prize-winners

Kyoto Prizes

Three Kyoto Prizes are awarded annually in the categories of Basic Science, Advanced Technology and Creative Arts and Moral Sciences to honour lifetime achievement. They include a commemorative gold medal studded with rubies and emeralds and a cash gift of \$350,000.

Advanced Technology Prize	1/17 female prize-winners
Basic Sciences Prize	1/14 female prize-winners

The Lemelson-MIT Awards

Established in 1994, the national Lemelson-MIT Awards consist of the world's largest single prize for invention and innovation.

Lemelson-MIT prizes (\$500,000)	0/6 female prize-winners
Lifetime Achievement Award (honorary)	2/5 female prize-winners

Japan Prize

Established in 1985, the Japan Prize is awarded to people from all parts of the world whose original and outstanding achievements in science and technology are recognised as having advanced the frontiers of knowledge and served the cause of peace and prosperity for mankind. No distinction is made as to nationality, occupation, race or sex. \$500,000

0/38 female prize-winners

The Charles Stark Draper Prize

Established in 1988, the prize honours innovative engineering achievement and its application to practice in ways that have contributed to human welfare and freedom. The 1999 Draper Prize will carry an honorarium of \$500,000.

0/8 female prize-winners

The Bower Prize for Achievement in Science, US

Established in 1988 and awarded by the Franklin Institute, the award includes a gold medallion and a cash prize of at least \$250,000.

1/9 prize-winners female

Lasker Awards

Established in 1946, the monetary rewards of this prize are small but since 1946, 59 winners of Lasker recipients have gone on to win the Nobel prize.

Basic science awards 1946–1998	5/115 female winners (4.3%)
Clinical awards 1946–1998	6/113 female winners (5.3%)

Louis-Jeantet Prize for Medicine:

1.12 million euros for research plus a personal award of 62,000 euros.

2/44 female prize-winners

The Jung Prize for Medicine, Germany

Established in 1976, has a current value of 102–204,000 euros.

0/48 female prize-winners

Paul Ehrlich Prize and Ludwig Darmstaedter prize, Germany

Established in 1952, the Paul Ehrlich prize is ‘the most distinguished award in biomedical research in Germany and one of the most important awards in the world’. Award comprises 61,000 euros and a gold medal.

From 1952–1999:	5/99 female prize-winners (5.3%)
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Prize Leopold Griffuel, ARC, France

Prize for oncology, established in 1990, has a current value of 106,000 euros.
2/29 female prize-winners

Prince of Asturias Prize, Spain

1981–present, no female winner in the sciences.

2) National prizes***US Medal of Science Winners***

1990 – present	12/84 female winners (12.5%)
1962 – present	22 /359 female winners (6%)

Leibniz Prizes, Germany

Established 1986. Up to 1.5 million euros awarded for research
13/181 female winners (7.2%)

Max Planck Research Prize, Germany

Established in 1990. Awards of up to 128,000 euros for international collaboration between a German scientist and a scientist working abroad.
So far, there have been 319 prize-winners.

Of those working in Germany	3/160 female (1.8%)
Of those working abroad	12/159 female (7.5%)

Prizes of French Physical Society

Prize Ricard, established 1971, 22,500 euros	1/29 females
Prize Robin, established 1917, 4,500 euros	2/61

The German-French (Gentner-Kastler Prize) and the French-English (Holweck Prize) have thus far not been given to women.

Jaime I Prize, Spain

In 11 years: one woman awarded prize in research, and two in clinical medicine.

Appendix VII

Table VII.1: Research grants, by research council and sex applications and success rates

Denmark 1996¹

	Applications			Grants			Success rate	
	Men	Women	% Women	Men	Women	%Women	Men	Women
Natural sciences	478	66	12%	259	31	11%	54%	47%
Medical research	443	176	28%	224	61	21%	51%	35%
Agricultural and Veterinary	98	28	22%	51	8	14%	52%	29%
Social science	132	50	27%	70	14	17%	53%	28%
Technical	152	11	7%	60	0	0%	39%	0%

Belgium, Fonds National de la Recherche Scientifique, 1998-1999²

Mandataires du FNRS et des fond associes aspirants				81	56	41%		
Chargés de recherche				40	21	34%		
Chercheurs qualifiés				14	9	39%		
Maîtres de recherche				5	1	20%		
Directeurs de recherche				2	1	33%		
Individual appointment	168	47	21%	78	25	24%	46%	53%
FRFC	700	117	14%	312	52	14%	45%	44%
FRSM (medical)	871	194	18%	565	121	18%	65%	62%
IISN (engineer nuclear)	72	3	4%	72	3	4%	100%	100%
Télévie (medical career oriented)	360	101	22%	201	63	24%	56%	62%

Finland, 1996 or 1997³

Funds for appointment								
Academy professors	84	14	14%	2	1	33%	2%	7%
Senior fellows	276	97	26%	43	15	26%	16%	15%
Junior fellows	307	180	37%	30	24	44%	10%	13%
Postdoc researchers	160	126	44%	23	19	45%	14%	15%
Academy research funds	1203	540	31%	443	199	31%	37%	37%

¹ Ministry of Research and Information Technology 1997

² Fonds National de la Recherche Scientifique 1998-99

³ Academy of Finland 1998

Information for the UK, Germany and Sweden is given in Chapter 4

Appendix VIII

Women on committees that set science policy

(all data are for 1999 unless otherwise stated)

I) European organisations

Joint Research Centres

Board of Governors 0/16 female

European Science Foundation (see Chapter 5)

Human Frontier Science Programme

Each committee consists of 18 members: 2 from each Member State and 2 nominated by the EU.

Board of Trustees	4/18 female
Council of Scientists	3/18 female
Review Committees	3 have 3/18 and one has 4/18 female members.

European Molecular Biology Organisation (EMBO)

Council	3/22 female
Fellowship Committee	1/11 female (who chairs the committee)

European Molecular Biology Laboratory (EMBL)

Scientific Advisory Board	3/16 female (chair female)
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Federation of European Biochemical Societies (FEBS)

Executive Committee	1/9 female
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2) Member States

Austria

Austrian Science Research Council

Presidents	0/5 female
Kuratorium	2/27 female

Belgium

National Research Science Fund (FNRS)

Only 13/26 scientific commissions have a woman.	
Total number of women	14/128 (11%)

Industry and agriculture research training fund (FRIA)

Only 16/27 juries have a woman.	
Total number of women	19 /99 (19.2%)

Flanders Fund for Scientific Research

Board	1/25 female (4%)
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Denmark

<i>Medical Research Council</i>	6/15 female (40%)
<i>Natural Sciences Council</i>	4/15 female (27%)
<i>Danish Cancer Society</i>	1/14 female (7%)

Finland (1997)

<i>Science and Technology Policy Council of Finland</i>	4/17 (24%)
<i>Academy of Finland</i>	
Board	2/7 female (29%)
Research Councils for Culture and Society, for Health and for Environment and Natural Resources each had	5/11 (45%).
Natural Sciences	1/11 (9%)
Experts consulted by the Academy in 1996	114/653 female (17%)
Foundation Boards	46/356 (13%) female
(for an extensive breakdown, see the report <i>Women in Academia</i>)	

France

Ministry of National Education, Research and Technology

National Council for Science	3/27 female
Higher Council for Research and Technology	
President	female
Members	11/40 females
Directors for Research, for Technology	2 men
National Council for Higher Education and Research (advises on general policies)	
Members	14/01 female (23%)

National Council for Universities (appointment and promotion of teaching staff)

Members 25% female

National Centre of Scientific Research (CNRS)

Director female

President male

Board of Executives 5/20 female (25%)

a) 2/20 (10%)

Scientific Council 9/37 female (24%)

Directors of Scientific Departments:

Human and Social Sciences female

Physical and Mathematical Sciences, 4 male

Engineering Sciences, Chemistry, female

Sciences of Universe

Life Sciences female; a) male

Department committees advisory the directors:

Nuclear Physics 0/5 female

Physical and Mathematical Sciences 2/17 female

Engineering Sciences 0/17 female

Chemistry 2/17 female

Science of Universe 0/13 female

Life Sciences 2/26 female

Human and Social Science 5/26 female

Only 1/40 scientific sections (Chemistry) has a woman president

a) before July 1999

National Institute for Agronomic Research (INRA)

Scientific Council

President and General Director 2 males

Members 5/26 females (19%)

Cancer Research Association (ARC)

Trustees 3/25 female

Scientific Council 0/14 female

Medical Research Foundation (FRM)

President male

General Director female

AIDS National Research Foundation

Director male

Four scientific cells heads 2 men, 2 women

Germany

Volkswagen Foundation

Kuratorium (top outside advisory body) 2/14 female (female chair)

Deutsche Krebshilfe (Cancer charity)

Executive Committee	1/10 female
Mildred Scheel Foundation	
Medical Advisory Board	0/13 female
Scientific Advisory Board	2/12 female

Greece**National Advisory Board on research policy and funding**

Physical and Mathematical Sciences	1/14 female
Biology-Biotechnology and Agriculture	1/10 female
Social Sciences, Humanities and Law	3/10 female
Medicine	3/10 female
Total	8/44 female (18.2%)

Italy**Italian National Research Council (CNR)**

President	male
Board-elected members	1/4 female
Appointed by Ministry of S&T Research	0/4 female
Scientific Committee	0/20 female

**Associazione Italiana per la Ricerca sul Cancro (AIRC)
(Cancer charity)**

Scientific Committee	2/14 female
Fellowship Committee	1/10 female

Telethon Italy

Board	1/12 female
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Netherlands

NWO Council, plus councils responsible for different disciplines	5/65 (7.7 %)
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Portugal**Fundacao para a ciencia e tecnologia**

President	male
Vice-presidents	1 male, 1 female
Directors	3 female

Spain**Consejo Superior de Investigaciones Científicas (CSIC)**

President	male
Board of Directors	9/27 female (33%)
Section Leaders	78/184 female (42%)
Scientific Personnel	624/2024 female (31%)

Oficina de Ciencia y Tecnología (OYCT)

Director	male
Vice-Director	2/0 female

Sweden**Medical Research Council**

Board	9/20 female (45%)
Evaluation Committees	5/13 (38%)

headed by women, 41% of the committee members are women.

Natural Sciences Research Council

Board	36% female
Evaluation Committees:	19% female
Biology	28% female
Chemistry	35% female
Physics	10% female
Geology	16% female
Mathematics	18% female

The Cancer Foundation (private)

Research Board	3/22 female (14%)
Evaluation Committees	0/8 headed by women

A 'working board' consists of these 8, plus a chair. All nine are men.

Evaluators	13/73 female (18%)
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UK**Council for Science and Technology (CST)**

Members:	4/15 female (27%)
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Research Councils:

Council for the Central Laboratories of the Research Councils	3/11 (27%)
Particle Physics and Astronomy Research Council (PPARC)	1/13 (7.6%)
Engineering and Physical Sciences Research Council (EPSRC)	2/14 (14.2%)
Natural Environment Research Council (NERC)	3/16 (18%)
Biotechnology and Biological Sciences Research Council (BBSRC)	3/16 (18%)
Medical Research Council (MRC)	3/14 (21%)
Economics and Social Research Council (ESRC)	5/14 (35.7%)
Total	20/98 (20%)

(NB in 1994 the four Natural Sciences Research Councils plus Council for Science and Technology plus Technology Foresight Steering Group had 7/96 (7.3%) female members)

Wellcome Trust (UK)

Governors	0/10 female
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(Note that a woman, Bridget Ogilvie, was director of the Wellcome Trust until 1998)

Imperial Cancer Research Fund

Scientific Advisory Board	0/10 female
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Appendix IX

Eurogroups, One Time Grants and Networks

A competitive science base needs to be able to attract and retain the brightest and best individuals into basic research in the Member States. This, coupled with the fact that women are poorly represented in many areas of science leads us to propose the following EUROGROUP scheme, to be funded by the EU. Such a scheme is a logical extension to the Marie Curie Fellowship, HCM, EMBO and HFSP schemes that have done so much to increase international exchange and to train scientists in different disciplines at the post-doctoral level. In the Fourth Framework Programme, 3,207 individuals were trained under the HCM Programme (see Chapter 4).

EUROGROUP leaders would be provided with their own salary, plus funds for a technician and 25,000 euros per year for running costs. Each EUROGROUP should be given a one off grant of 50,000 euros for equipment. This would create a cost to the Framework Programme of around 600,000 euros per group, assuming that groups are funded for five years. 750 awards should be given for groups to be established during the Sixth Framework Programme. The cost is estimated at around 43 million euros or about 0.55% of the budget of the Fifth Framework Programme. Selection should be based on the originality of the research plan and the quality of the applicant.

To ensure the international nature of the programme, awards would be restricted to:

- those returning after at least two years abroad, in which case awards could be held in the applicants' country of origin or in a second Member State;
- applicants wishing to establish an EUROGROUP in an EU Member State of which they are not a citizen or permanent resident, or to develop their own project while associated with an existing group at an institution within the Member State.

Awards would be *ad personam*. A minimum of 40% the awards should be given to women and a minimum of 40% to men. The board allocating the fellowships should be drawn from the EU Member States and be comprised of equal numbers of women and men. Provision should be made to bring

EUROGROUP winners together, thus encouraging international contact, and for the exchange of personnel where appropriate between the different EUROGROUPS.

One Time Grants

They could be modelled on the short term EMBO or FEBS Fellowships but be open to all disciplines, or it could be modelled in part on the HSP Programme in Germany which provides contact stipends, re-entry stipends and work contracts for women scientists who interrupt their careers.

Another possibility would be to include aspects of the POWRE (Professional Opportunities for Women in Research and Education) programme at the US NSF BIOPOWRE awards are ‘designed to provide a one time input of funds at a critical stage in the Principal Investigator’s career, a means by which she can take advantage of an opportunity that will contribute to a significant, identifiable advance in her career path’.

HYPERLINK <http://www.nsf.gov/bio/puns/powre/bpowre00.htm>

Networks

The development of networks linking individuals interested in different disciplines or different topics can be a means of exchanging information and connecting individual scientists in the different Member States.

Member States should also be encouraged to consider funding along the lines suggested above. Availability of additional funds within the Member States for instance for *ad personam* junior groups, modelled on the Eurogroups described above, would reduce dropout. Attention is drawn in particular to two such programmes already in existence – the Dorothy Hodgkin Programme in the UK, which is set up to be woman-friendly and the Emmy Noether Programme that has just been initiated in Germany. Both are described in Chapter 4. In addition Member States could also consider funding One Time Grants and Networks, as well as Positive Action Programmes of the types listed on page 92.



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