THE RISING TIDE

A report on Women in Science, Engineering and Technology

LONDON: HMSO

ISBN 0 11 430096 8

Printed in the United Kingdom for HMSO
Dd297366 2/94 C10 G3397 10170

There is a tide in the affairs
of men, which, taken at the flood,
leads on to fortune

William Shakespeare

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PREFACE

Following a number of consultations the Chancellor of the Duchy of Lancaster, the Rt Hon William Waldegrave, established a Committee on Women in Science, Engineering and Technology in March 1993. This Committee was supported by a Working Group. Its task was to prepare a report identifying actions to further science, engineering and technology by making further use of the talents of women, and to enable women more fully to realise their potential. The terms of reference of the Committee were:

"To advise the Office of Science and Technology and the Chancellor of the Duchy of Lancaster on ways in which the potential, skills and expertise of women can best be secured for national advantage and for the benefit of science, engineering and technology".

It was agreed that this must be an independent report by individuals not only interested in the subject, but who were, or had been, active practitioners in science, engineering and technology and who held considered views on these issues. It was agreed that I would chair the Committee as a link with the Office of Science and Technology with its overall responsibilities for science, engineering and technology. Dr Jean Balfour was appointed as Deputy Chairman and she chaired the meetings of the Committee, whilst Dr Nancy Lane chaired the Working Group which brought draft proposals to the Committee for consideration.

This report is the result of much detailed discussion of the issues by the Committee and Working Group. It brings forward their views on ways ahead in this important area which impacts not only on science, engineering and technology, but also touches the social fabric of society as we move towards the twenty-first century.

WILLIAM D P STEWART
Chief Scientific Adviser

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THE POTENTIAL TO BE REALISED

1.1 By the year 2000, Great Britain will have approximately 23.5 million women aged 16 years or over; women will represent 46 per cent of the civilian labour force. Demographic trends and changes in economic activity rates show that four-fifths of the projected net increase in the civilian labour force in Great Britain to the year 2006 will be women[1]. The full potential of this expanded labour force needs to be tapped.

1.2 One area of particular importance in underpinning our economic competitiveness and quality of life is science, engineering and technology (SET). The Government in its recent White Paper *Realising Our Potential: A Strategy for Science, Engineering and Technology*[2], acknowledges that women are the country's biggest single most under-valued and therefore under-used human resource.

1.3 At the beginning of the 20th Century it was unusual for women to enter higher education while few took up professional training. It was even more unusual for them to contemplate becoming scientists and engineers (this report is not concerned with the social sciences). Since then there has been progress, but it has been slow. Today women still form only a small proportion of those engaged in practising and managing science, engineering and technology. Among those that do, some enjoy rewarding careers and have demonstrated clearly that at the highest level they can compete effectively and establish international reputations for excellence in their chosen careers.

1.4 There are still many obstacles which deter talented women from studying SET or make it difficult for them to achieve their full career potential. However, there is a rising tide of awareness that the loss of ability and skills caused by gender bias is neither acceptable nor in the national interest.

1.5 Apart from the personal rewards of a challenging career, there is a sound economic case for attracting and retaining more women in SET. Not least is the need to harness the abilities and skills necessary to improve the UK industrial position in increasingly competitive world markets. It is widely accepted that a population skilled in SET is essential to the advancement of design, product development and manufacturing, and hence to national wealth creation.

1.6 We recognise the benefits of recruiting and retaining women scientists and engineers at all levels of employment. This will increase the pool of talent from which high calibre scientists, engineers and technologists, and the future leaders in SET, can be drawn, and create a workforce with a greater diversity of skills. The nation's future prosperity depends on education and training, and

on the development of an experienced workforce with high-quality skills and the knowledge to expand and to apply the new technologies of the modern world.

1.7 The cost of training scientists, engineers and technologists is high. Therefore, if the expertise of qualified women scientists and engineers is under-used or lost to the workplace, this represents a financial loss to the nation.

1.8 As the White Paper emphasised, there are economic and social benefits to be gained for a society which has a clear understanding and awareness of scientific and technological issues. Trained scientists and engineers may move into other fields such as industrial management, school teaching, journalism or public administration. In these circumstances their education and training enables them to bring to their work an understanding of the positive contribution which SET can make to wealth creation and the quality of life.

1.9 Three principal questions need to be considered:

- *The first concerns education and training.* The number of applicants of both sexes for science and engineering courses in Higher Education has been lower for a number of years than the number applying for arts, humanities, social sciences and business studies. Policies to encourage more girls to study science subjects address part of the more general problem of attracting more able young people of both sexes into careers in science and engineering. Education reforms have had as one of their aims the encouragement of more young people to study SET throughout their school careers and beyond[3]. There is a variety of reasons why girls do not take up science and engineering and we seek to address some of these issues, in particular, **how can we ensure more girls become sufficiently interested in science, engineering and technology to choose to study these subjects at school, college and university?**

- *The second is about employment.* Many of the problems encountered by women scientists and engineers are common to all professional women. Some of our recommendations therefore apply to all women at critical stages of their careers. Women scientists and engineers, however, have particular problems in that the period when their careers are at a crucial stage often coincides with the years of child-raising. The increasing pace and demands of scientific research and technological development, together with competition for permanent posts, can make it exceptionally difficult to take even a short career break. As more families choose to share caring responsibilities, men as well as women will increasingly face this difficulty.

The dropout of able young women from employment in SET fields is a key issue. It is related to family commitments and to lack of opportunities for career advancement. A further factor may be the perceived status of scientists and engineers. Thus, **how can careers in science and engineering be made more accessible and attractive to women, and their skills and expertise be effectively used?**

- *The third concerns leadership and decision-making roles.* Women are still very poorly represented in senior appointments in both the public and private sector and on influential policy-making bodies. **How can it be ensured that more women are represented on, and chair, boards and bodies responsible for developing and managing policy on SET?**

Underpinning all three is the question of how greater public awareness of the contribution which women make to these fields can be developed.

1.10 This report emphasises the importance of equality of opportunity for men and women alike in education and employment, and the contribution that this makes to SET. Equality will only be achieved by ensuring that both are educated fairly and managed competently in their place of work.

SUMMARY OF RECOMMENDATIONS

1.11 The report's recommendations, which seek to address these issues, are summarised below under the headings Education, Employment, Women at the Top and A Higher Public Profile for Women in SET. Central to the practical measures set out in the report is our recommendation that **a Development Unit should be established under the auspices of the Office of Science and Technology for an initial three year period to take forward those recommendations which would benefit from action and coordination by a dedicated unit.**

1.12 The recommendations in this report will also benefit from overall consideration and advice on their implementation. **We therefore recommend that the Council for Science and Technology be invited to consider this report.**

EDUCATION

i. All children need to acquire basic technical skills and some understanding of science. Science and engineering are often still perceived as 'masculine' subjects and the dominance of men in SET-related careers reinforces this stereotyped view. Such influences begin at home with parental

attitudes and are strengthened by the educational process, peer pressure, and popular culture. The attitudes and behaviour of teachers are especially important.

We recommend that Government Education Departments and education and training establishments ensure the initial and in-service training of teachers on equal opportunities issues includes guidance on means of maintaining the interest of girls as well as boys in all science subjects;

We further recommend that the Office for Standards in Education (OFSTED) routinely review the status and effectiveness of equal opportunities policies in schools.

ii. The current Advanced ('A') level system in England, Wales and Northern Ireland is considered by many to be too specialised, too limited and divisive. It requires young people to make decisions at an early age which may affect their future careers. We have noted that too few young people, particularly girls, are choosing to include sufficient science to continue the subject in higher education. The Scottish Higher Education Certificate model involves a wider range of subjects and, in contrast to England and Wales, has resulted in an increasing number of young people taking science and mathematics to higher education entrance standard over the past four years.

We recommend that, when reviewing post-General Certificate of Secondary Education (GCSE) courses in England, Northern Ireland and Wales, the Department for Education, the Department of Education for Northern Ireland and the Welsh Office Education Department should consider the advantages of a broader curriculum in encouraging more young people, particularly girls, to continue to study science beyond the age of 16, taking note of the Scottish experience.

EMPLOYMENT

iii. Good management is about the effective use of resources, especially people. In SET, this is particularly important since the recruitment and training of highly qualified employees is costly. Management practices which maximise the skills and potential of women, as well as men, benefit employers and employees alike.

We recommend that equal opportunities policies should be a recognised part of an organisation's or company's strategy. The implementation of these policies should be monitored and reported in Annual Reports.

iv. During our consultations we noted several examples of good employment practice, and two initiatives in particular: 'Investors in People' offers a national standard to encourage employers to invest more effectively in developing all their employees to achieve business objectives; 'Opportunity 2000' has mounted a successful enrolment campaign to increase the quality and quantity of women's participation and advancement in the workforce.

We recommend that the Office of Science and Technology Development Unit work with 'Investors in People' and 'Opportunity 2000' to build on these initiatives to address the specific needs of women in SET.

v. Responses to a questionnaire circulated to companies by the Working Group provided several examples of current good management practice. These included the development of comprehensive 'family friendly' policies, personal development plans for women employees, 'keeping in touch' programmes for those on career breaks, 'tele-working' with home computer terminals, and career support for those with caring responsibilities.

We recommend that the Office of Science and Technology Development Unit initiate a series of pilot studies to identify and disseminate information on the economic and other benefits of existing women friendly management practices in SET.

vi. The combination of work and family responsibilities can pose problems for either parent, but because it has been usual for women to take the main responsibility for child-rearing it impacts most severely on them. If young women can continue in employment at this stage of their career it will enable them to realise their full potential and provide the opportunity to progress to senior positions in SET. A key factor in achieving this will be the availability of affordable childcare and nursery provision. This has been emphasised to us throughout our consultations.

We recommend that the Government should allow childcare costs to be claimable against employees' income tax, where both parents, or a single parent in single parent families, are working. In addition, the Government should increase the provision of publicly-funded childcare services.

vii. Returners schemes are an important means of offering mature students, particularly women, flexible access to acquiring the skills and confidence which they need to return to employment. The funding, however, is fragmentary and insecure, putting the future of some successful schemes in jeopardy.

We recommend that the Department of Employment should facilitate national support and funding for successful returners schemes for women in SET, to help secure the future of these schemes and enable greater numbers of potential women returners to take advantage of this type of training.

viii. The White Paper 'Realising our Potential' recognised that the current pattern of contract staff in universities is a matter for concern. It looked to the Research Councils to adapt their grant-making arrangements to improve the career opportunities for research staff. The importance of this issue was also stressed in our consultations.

We recommend that funding bodies should make research funding arrangements for principal investigators and research fellows more flexible so that potential award holders are not disadvantaged if their mobility or availability for full-time work is restricted by family commitments. The Government's Annual Forward Look of Science and Technology should provide information on the extent to which the Research Councils are addressing this issue.

ix. There are various reasons why women do not pursue their careers in SET. Some of these could be addressed if women had access to a SET-orientated regional service which advised on career development and opportunities for flexibility within employment. Adult career guidance is piecemeal and, while there are organisations which can provide advice on career development in SET, many are voluntary and patchy in availability. A more coordinated service is necessary to address the needs of SET. This, in the first instance, might take the form of an experimental service in a few regions of the UK to explore how such a service might be targeted. It would be expected that the service would become self-financing.

We recommend that the Office of Science and Technology Development Unit, in consultation with the Department of Employment, examine the provision of a regional careers development advisory service in SET, building where possible on existing regional schemes and networks.

WOMEN AT THE TOP

x. Women are seriously under-represented in senior positions, including appointments as chairmen, on influential boards and public bodies or committees responsible for developing and managing policy on science and engineering and in employment generally. Mechanisms for identifying suitable women candidates need to be strengthened.

We recommend that employers and professional institutions, should set up and maintain their own databases and networks of women scientists and engineers qualified for appointment to their boards and committees, or for nomination to public appointments. A central catalogue of databases should be held by the Office of Science and Technology, and updated annually, to disseminate this information.

xi. To increase numbers of women in senior positions and on policy-making bodies, meaningful targets have to be in place which can be reviewed and monitored effectively.

We recommend that Government Departments and other employers should set targets specifically for all public appointments and senior positions in SET, including chairmanships, of at least 25 per cent qualified women by no later than the year 2000.

A HIGHER PUBLIC PROFILE FOR WOMEN IN SET

xii. The image and status of scientists, engineers and technologists are strongly influenced by the media. However, the media focus only occasionally on the part which women play in these fields, and rarely depict women in science and engineering jobs as a normal occurrence.

We recommend that the Office of Science and Technology should further develop its strategy for promoting public awareness and maintaining contact with media outlets, and should encourage coverage of the contribution women make to SET.

THE PRESENT POSITION : AN OVERVIEW

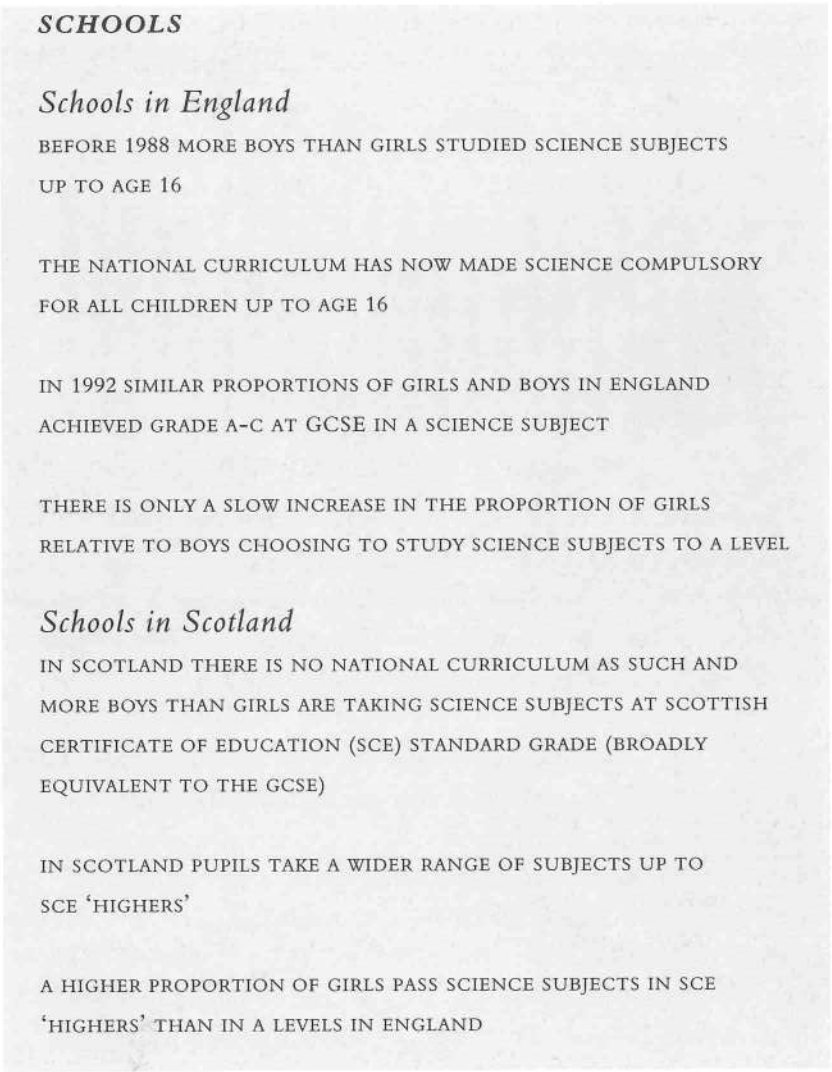
2.1 Women have made significant progress in professions and skilled occupations since World War II, when the marriage bar disappeared, and following the passing of the Equal Pay Acts from 1970, the Sex Discrimination Acts from 1975, and the Employment Protection Act in 1975. Nevertheless, women are still under-represented within SET fields and few are to be found in senior positions.

2.2 In this Chapter we seek to provide an overview, mainly through the presentation and analysis of data, of the present level of participation of women in SET within education and employment. We consider: the choices and successes of girls and women in science and engineering subjects through the education system, the role of women in science and engineering occupations and their prospects of progressing to senior positions. Much of the data has been drawn from England and Wales. Whereas the education patterns are broadly similar in Northern Ireland, there are important differences in Scotland. These have been highlighted. Observations on the European and international situation are included.

EDUCATION AND TRAINING

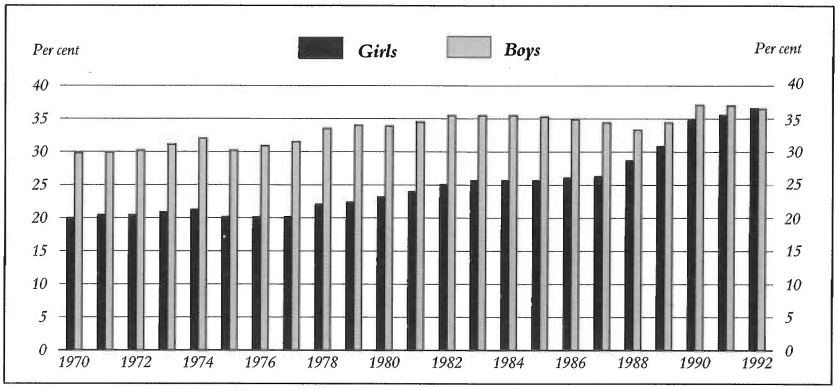
IN SCHOOLS

2.3 With the introduction by the *Education Reform Act 1988* of the National Curriculum in all maintained schools in England and Wales, and its adoption by many independent schools, science teaching has changed. All children aged 5 to 16 must follow the compulsory core subjects of science, based on a balanced science approach, mathematics and English, together with a number of foundation subjects, one of which is technology. At GCSE level, pupils may opt to study either double science or single science, which are both balanced science courses, or the three separate sciences, biology, chemistry and physics. Pupils who opt to follow separate sciences at GCSE level must study all three separate sciences. There is no opportunity to study only one or two. By the year 2000 all pupils will have followed the National Curriculum throughout their 11 years of compulsory schooling; in 1994 the first cohort of pupils to have followed the National Curriculum in secondary schooling will take GCSE examinations. Curriculum arrangements broadly similar to those in England and Wales are being introduced in Northern Ireland.



2.4 Figure 1 shows the proportions of girls and boys gaining at least one science GCSE or Ordinary ('O')level/Certificate of Secondary Education (CSE) examination at grade A-C (or CSE Grade 1) in England. In the years prior to the introduction of the GCSE in 1988, there was little increase in the proportions of girls gaining at least one science examination at this level and little sign of a narrowing of the gender difference which existed.

FIGURE 1 : PERCENTAGE OF BOYS AND GIRLS WITH AT LEAST ONE PASS AT GRADE A-C AT O LEVEL/GCSE (CSE 1) IN A SCIENCE SUBJECT, ENGLAND, 1970 - 1992



Source: DFE School Leavers Surveys and School Examination Surveys

However, there was a marked change following the introduction of the GCSE. In 1987 about 26 per cent of girls and 34 per cent of boys were successful at 'O'level grade A-C or equivalent. By 1992 36.6 per cent of 16 year old girls and 36.5 per cent of boys had achieved grade A-C in at least one science subject. The same proportion of girls were successful in Mathematics.

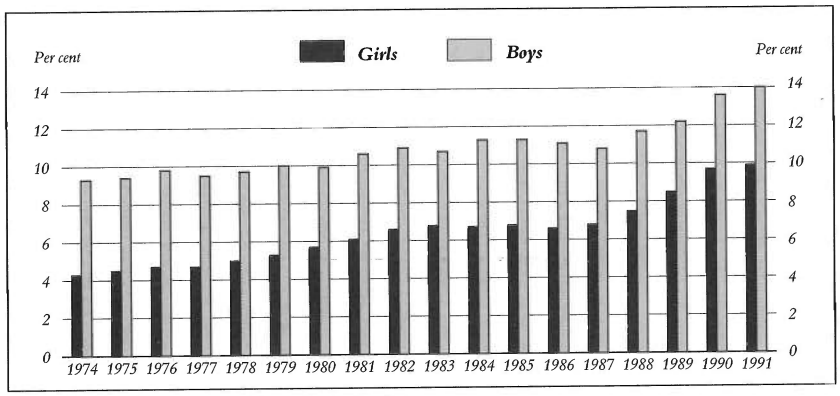
2.5 The above results suggest that given the opportunity girls can do at least as well as boys in science subjects up to the age of 16. When girls opted out of science previously, this would appear to be a question of choice rather than ability. Subject preferences across the curriculum are demonstrated in the GCSE results where girls outperform boys by a higher margin in subjects other than Mathematics and Science. For example, in English in 1991 56 per cent of girls obtained one of the top three grades, compared to 40 per cent of boys[4]. The success of girls in recent GCSE examinations may indicate that they respond better to the broader GCSE syllabuses and the new styles of examining.

2.6 The National Curriculum does not operate in Scotland and at the SCE Standard grade, taken at age 16, gender differences are very much in evidence in the separately studied science subjects. In 1991 SCE standard grade Physics passes amongst boys outnumbered those of girls by about 2 to 1, while in biology girls outnumber boys by 2 to 1. This pattern has changed little over the last decade[5].

2.7 In England and Wales, after the age of 16 students choose, typically, two or three subjects to study for GCE 'A'levels. Arts or science subjects may be dropped. In the 1991 examinations 14 per cent of boys and 10 per cent of girls achieved at least one 'A'level pass in an SET subject (Figure 2). However the subject bias is strong. In 1992, fewer girls than boys obtained an 'A' level in

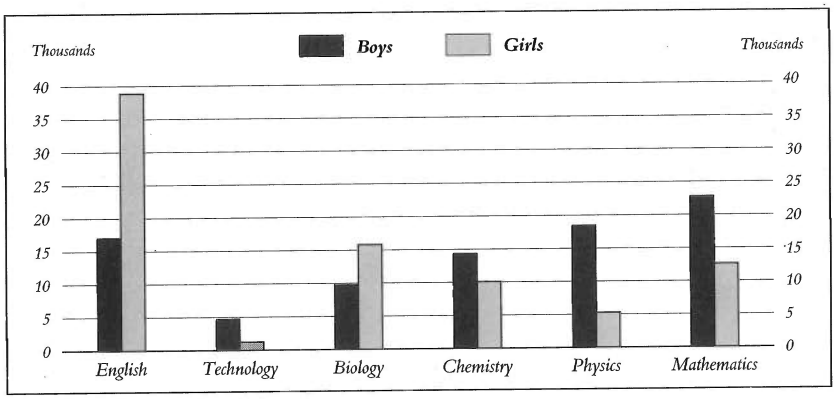
Mathematics and Chemistry, and an even smaller number in Physics and Technology (Figure 3). More girls than boys obtained 'A'level biology, although the number was far fewer than those girls who obtained an 'A'level in English. Pass rates are similar for girls and boys in science and mathematics (Table 1). With the exception of biology, fewer girls currently opt to study these subjects.

FIGURE 2 : PERCENTAGES OF 18 YEAR OLD BOYS AND GIRLS IN ENGLAND WITH AT LEAST ONE A LEVEL PASS IN A SCIENCE SUBJECT, 1974 -1991



Source: DFE School Leavers Surveys and School Examination Surveys

FIGURE 3 : NUMBER OF A LEVEL SUCCESSES BY SUBJECT, ENGLAND, 1992



Source: DFE Statistical Bulletin 15/93

Table 1 : Success rates[1] of GCE 'A' level examination candidates aged 18 years or under in selected subjects in all schools and colleges, 1991/92

Subject	*Candidates Boys*	*Success % Boys*	*Candidates Girls*	*Success % Girls*
Technology	6152	77.7	1528	82.1
Physics	23520	80.4	6680	82.0
Chemistry	17926	82.3	12634	82.2
Mathematics	31525	77.2	16972	78.3
Biology	12506	80.6	20149	79.3
English	20062	85.9	44859	87.6

1 *The total number of Grade A-E passes as a percentage of the total number of attempts.*
Source : DFE Statistical Bulletin, Issue No 15/93, June 1993.

2.8 Other factors, as well as intellectual ability, influence girls to continue their education in subjects other than science. Influences and attitudes from an early age, subject grouping, ability, and teaching methods and the approach in the classroom all impact on the choices which children make.

2.9 There is evidence to suggest that a broader based curriculum during post-16 education would offer a flexibility beneficial to girls and boys in SET. A number of leading professional and educational organisations have drawn attention to the restrictive nature of the early specialisation in the current 'A' level system in England and Wales. In Scotland pupils normally take up to five subjects in the SCE Higher grade at age 17 and the differences in girls' and boys' subject choices and examination results are much smaller than in 'A'levels. In 1991 girls achieved almost half the passes in Mathematics and Chemistry (as compared with 36 per cent and 41 per cent respectively in England) and a third of those in Physics (22 per cent in England)[5].

2.10 Teachers, depending on their competence, encouragement and example, can strongly influence the subject and career choices of pupils. An important way of breaking down the gender stereotyping which may dissuade girls from studying SET is for pupils to be taught by both men and women who are enthusiastic, and well-qualified in science subjects.

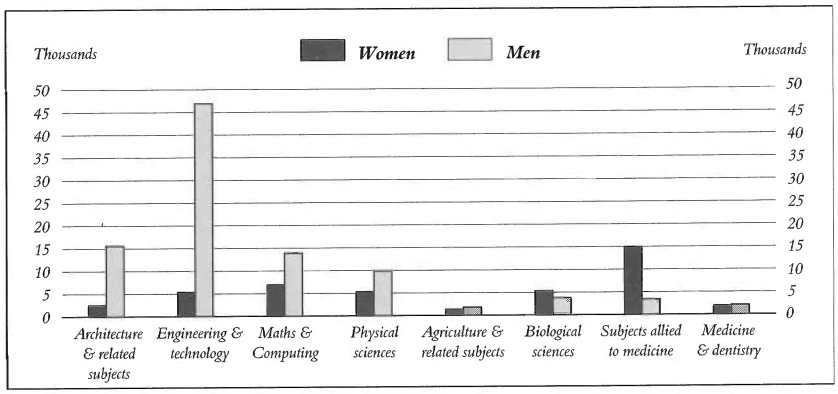
2.11 A higher proportion of women in senior positions in education and its administration could also lead to a better understanding of the changes and improvements required. Progress in the advancement for women within the teaching profession is slow. In maintained nursery and primary schools in England and Wales, 81 per cent of all full-time teachers are women, but only 49 per cent of head teachers. In secondary schools, 48 per cent of teachers are women, but only 20 per cent of head teachers. The 1990 figures show little improvement since 1980[6].

HIGHER EDUCATION

2.12 There has been rapid expansion in recent years in the number of students taking courses in Higher Education (HE). New entrants to HE in England rose by 70,000 (28 per cent) between 1980 and 1988, and by 100,000 between 1988 and 1991 (a further 31 per cent), to reach a total of 394,000. The numbers of women students increased over this period, and in 1991 just under a half of all entrants were women compared to just over a third in 1980[7]. In Scotland 49 per cent of all entrants to HE in 1991 were women[5].

2.13 However, the take up of higher education courses in SET subjects by women has primarily been in the biological sciences and in studies allied to medicine. Women are still a minority in the other sciences and engineering (Figure 4).

FIGURE 4 : NUMBER OF NEW ENTRANTS TO HIGHER EDUCATION BY SUBJECT, ENGLAND, 1991



Source: Further Education Statistical Record/Universities' Statistical Record

HIGHER AND FURTHER EDUCATION

Higher Education

THERE HAS BEEN A RAPID EXPANSION IN THE NUMBER OF STUDENTS IN HIGHER EDUCATION OVER THE LAST FEW YEARS

THE PROPORTION OF WOMEN ROSE FROM JUST OVER A THIRD IN 1980 TO JUST UNDER HALF IN 1991

MATHS, SCIENCE AND TECHNOLOGY SUBJECTS HAVE MAINTAINED THEIR SHARE OF HE DURING THIS PERIOD

THE PROPORTION OF WOMEN ON COURSES IN THESE SUBJECTS HAS INCREASED

NEVERTHELESS, MOST OF THE ADDITIONAL PLACES IN SCIENCE AND TECHNOLOGY HAVE BEEN TAKEN UP BY MEN

WOMEN ARE GENERALLY LESS WELL REPRESENTED IN SCIENCE SUBJECTS AT POSTGRADUATE THAN AT FIRST DEGREE LEVEL

Further Education

FURTHER EDUCATION COURSES ARE PROVIDING GREATER FLEXIBILITY OF ACCESS AND STUDY THAN EVER BEFORE

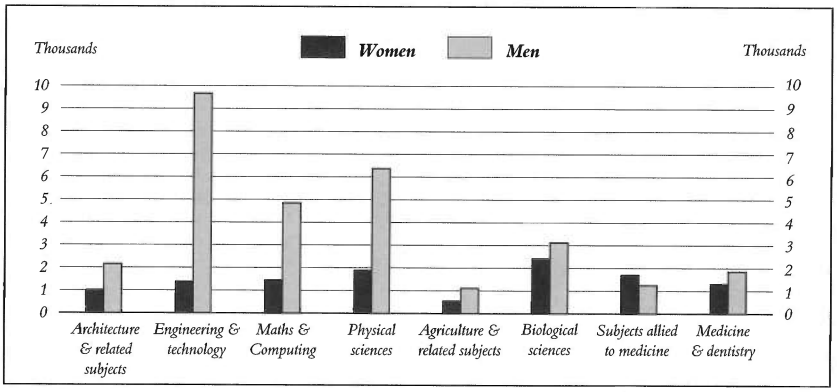
IN 1991/92 WOMEN ACCOUNTED FOR MORE THAN 1.1 MILLION ENROLMENTS ON FURTHER EDUCATION (FE) COURSES IN ENGLAND

IN SPITE OF THIS THE LOW TAKEUP OF WOMEN IN ENGINEERING AND TECHNOLOGY SUBJECTS IS THE MOST STRIKING DISPARITY OF THIS SECTOR

2.14 In 1991 the proportion of women entering HE courses in England in engineering and technology was 13.7 per cent, but this figure is still low. Most of the 35,000 extra SET places which arose between 1988 and 1991 have been taken up by men. The differential in the absolute numbers of men and women entering HE to read these subjects has therefore become greater every year.

2.15 The under-representation of women in SET subjects at undergraduate level is accentuated at postgraduate level. The number of full-time women postgraduate students in Great Britain increased by nearly 50 per cent between 1988 and 1991[8]. Women however are still only 27 per cent of full-time science postgraduates and 10-25 per cent of students in engineering, mathematics and the physical sciences (Figure 5).

FIGURE 5 : NUMBERS OF FULL-TIME POSTGRADUATES BY SUBJECT, GREAT BRITAIN, 1991/92



Source: DFE Officials

2.16 The employment prospects of science and engineering graduates are somewhat better than those of arts graduates. In 1991 and 1992, 46 per cent of science and engineering graduates found a permanent job in the UK, as opposed to 35 per cent of arts graduates. However, women are lost from SET at each stage, and in 1991 28 per cent of male graduates went on to work in SET fields, but only 9 per cent of female graduates[9].

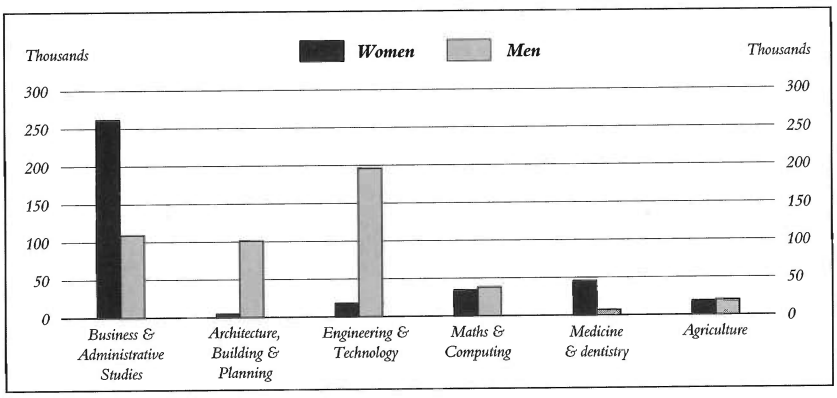
FURTHER EDUCATION

2.17 A third of the 16-17 age group in 1991-92 went on to Further Education colleges, either as full-time students (23 per cent) or as part-time students (12 per cent)[10]. A considerable number of people also returned to education by enrolling on FE courses later in life. There is a diversity of flexible courses in this sector which can lead to a wide range of qualifications covering both academic and vocational skills.

2.18 This is an important sector of post-school education for women. In 1991-92 women accounted for more than 1.1 million enrolments on FE courses in England, 57 per cent of the total. There were more than 100,000 enrolments on each of the courses leading to Business and Technology Education Council (BTEC), City and Guilds, Royal Society of Arts Examinations Board (RSA), GCSE as well as 'A' and Advanced Supplementary ('AS')level qualifications. Most of these women attended courses on a part-time basis, and approximately half of all women on FE courses were aged 25 or more[10].

2.19 Nearly as many women as men enrol on courses in mathematics and computing sciences, and women are well represented on medicine and science courses (Figure 6). However, in engineering and technology, one of the largest sectors in FE, women are strongly under-represented at less than 10%.

FIGURE 6 : NUMBERS OF FURTHER EDUCATION ENROLMENTS BY SUBJECT, ENGLAND, 1991/92



Source: DFE Statistical Bulletin 14/73

EMPLOYMENT

INDUSTRY

2.20 Analysis of the numbers of professional people in SET- related occupations shows a familiar pattern of decreasing numbers of women from biological to the physical sciences, and to engineering (Figure 7). The only occupation in which women outnumber men is that of laboratory technician (57 per cent). Women form an extremely small proportion in traditional forms of engineering (2-6 per cent), slightly more in electronic, planning and control (11-12 per cent), increasing to chemical science (20 per cent), and to biological science (33 per cent).

EMPLOYMENT

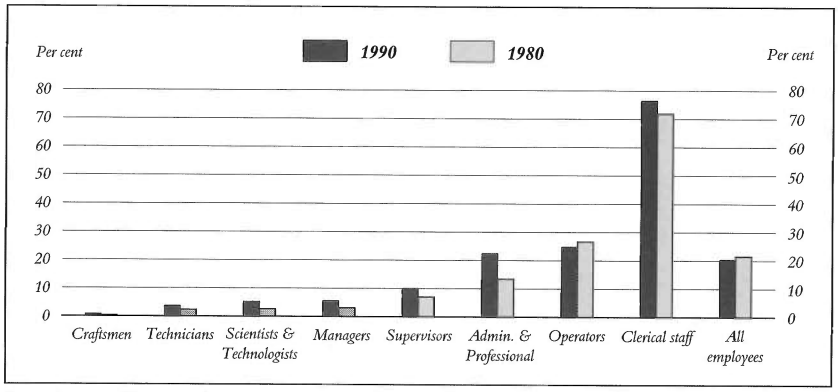
Employment

THERE ARE FAR FEWER WOMEN THAN MEN EMPLOYED AS SCIENTISTS, TECHNOLOGISTS OR ENGINEERS IN THE UNITED KINGDOM

THE PROPORTION OF SCIENTISTS WHO ARE WOMEN IS SMALLER THE HIGHER THE LEVEL OF APPOINTMENT IN INDUSTRY, THE CIVIL SERVICE AND ACADEMIA.

2.21 Figure 8, which analyses the jobs undertaken by men and women scientists and engineers within the Engineering Industry in 1991, illustrates the principle 'the higher the fewer'. The only jobs in which women form a high proportion of the workforce are clerical ones. It is noteworthy that while over the period 1980 to 1990 the proportion of women employed in the Engineering Industry fell, the proportion of clerical jobs held by women increased. Men filled nearly all of the management positions. The total numbers of women scientists, technologists, technicians and craftsmen increased during the 1980s but are still very small.

FIGURE 8 : PERCENTAGES OF WOMEN BY JOB TITLE IN THE ENGINEERING INDUSTRY IN GREAT BRITAIN



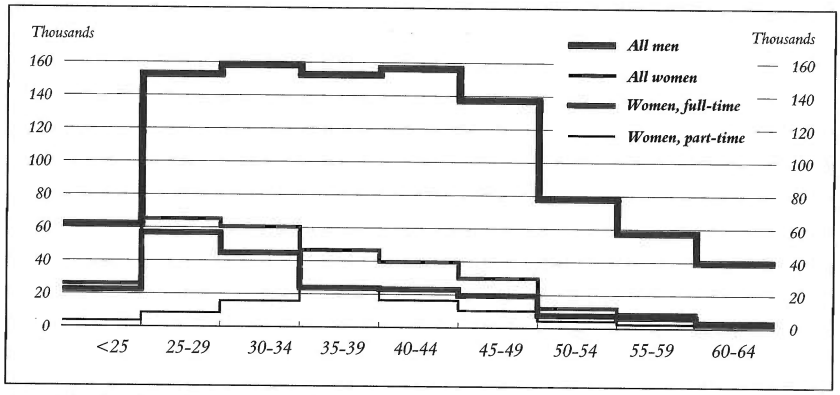
Source: Engineering Training Authority

2.22 In the period 1981-92 the SET workforce grew by 50 per cent and the proportion of women grew more than threefold, from 8.5 per cent to 29.5 per cent[11]. Figure 9 shows the numbers of men and women qualified at degree level or equivalent in SET in employment in 1992 by quinquennial age group. The profile for men shows a broad maximum, spanning the age range from 25 to 45-49, before the numbers decrease with age. The profile for women, however, shows a gradual decrease from age 25-29. The number of women working part-time increases from an early age, peaking for the 35-39 age group, before decreasing. The increase in part-time working does not, however, mirror the decrease in full-time working and it is evident that a number of women qualified in SET are lost permanently to the workforce during these years.

FIGURE 7 : NUMBERS OF MEN AND WOMEN IN EMPLOYMENT IN SCIENCE, ENGINEERING AND RELATED OCCUPATIONS, GREAT BRITAIN, 1991

Source: Labour Force Survey

FIGURE 9 : MEN AND WOMEN QUALIFIED IN SCIENCE, ENGINEERING AND TECHNOLOGY IN EMPLOYMENT IN 1992, BY QUINQUENNIAL AGE GROUP



Source: Labour Force Survey. The categories summed are engineering, technology, natural sciences, medical science, agricultural science, mathematics,/statistics/computing, architecture/building/planning, and combinations: science

2.23 A questionnaire sent to industry during consultation revealed that, of the 40 per cent of companies that responded (see Annex B) nearly all have a statement of equal opportunities policy[12]. However only 58 per cent of these companies monitor the success or otherwise of this policy and provide annual statistics on the numbers of women employed and promoted. Only 8 per cent of employees in the top four levels are women, although 36 per cent of respondents indicated that they had already set goals for women's appointments to senior positions. Most of the companies now have some links with educational institutions to attract students into SET careers, and some have specific arrangements to encourage women into SET.

THE PUBLIC SECTOR

THE CIVIL SERVICE

2.24 A Programme of Action to Achieve Equality of Opportunity for Women in the Civil Service was inaugurated in 1984. Its implementation has been monitored in five Progress Reports. The 1991/1992 Progress Report[12] reviews the position of women in the Civil Service, including specialists and those qualified in SET subjects. It reports some narrowing across the Service of the gap between men and women's resignation rates; developments in equal opportunities awareness training; the development of methods of training other than residential courses; progress in managers' accountability and increased availability of childcare.

2.25 Nevertheless, employment patterns found within industry are largely repeated within the Public Sector. Among the Scientists, Professional and Technology (P&T) Officers and Information Technologists in the Civil Service in 1992 women are in the minority. The proportion declines at each higher grade.

2.26 Overall, in 1992 21 per cent of scientists were women but only 9 per cent of the Senior Scientific Officer grade (Table 2). Among Professional and Technology Officers women form only 3 per cent of personnel and are concentrated in the technician grades (Table 3). However women now make up 18.5 per cent of trainees, and this provides some encouragement that the situation may improve.

Table 2 : Number and proportion of Women in the Science grades in 1992

Grade	*Total number in grade*	*Total number of women in grade*	*Women as a % of the total in grade*
Senior Scientific Officer	2807	264	9
Higher Scientific Officer	2871	561	20
Scientific Officer	2608	683	26
Assistant Scientific Officer	1504	519	35

Source: Equal Opportunities for Women in the Civil Service: Progress Report 1991-92, ISBN 0-11-430076-3, HMSO.

Table 3 : Number and proportion of Women in the P&T grades in 1992

Grade	*Total number in grade*	*Total number of women in grade*	*Women as a % of the total in grade*
SPTO	5121	77	1.5
HPTO	7085	128	1.8
P&TO	9456	135	1.4
Trainees	653	121	18.5
Technical Grade 1	577	226	39.2
Technical Grade	92	38	41.3

Source: Equal Opportunities for Women in the Civil Service: Progress Report 1991-92, ISBN 0-11-430076-3, HMSO.

2.27 In Information Technology women are better represented and form 39 per cent of all staff. However, this representation again falls at the higher grades, to 13.5 per cent at Senior Executive Officer and 8.6 per cent at Grade 7.

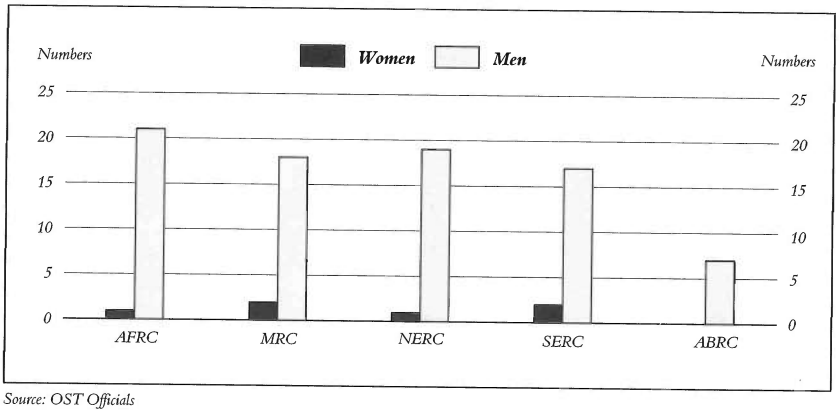
2.28 For women to advance to senior positions they must have real equality of opportunity at all stages in their career. A cohort study of those entering the Civil Service fast stream between 1978 and 1981 found that women and men took 5-6 years to reach Grade 7. This pattern changes in the higher grades. Of those reaching Grade 7 by 1985 and still in service in 1991, 34 per cent of the men had reached Grade 5 but only 16 per cent of the women. Although the sample numbers in this study were small and the analysis not conclusive, the overall picture is significant.

2.29 On 1 April 1993, 51.2 per cent of civil servants in the non-industrial Home Civil Service were women. Just over 9 per cent of posts in the Senior Open Structure (Grades 1-3) and 8 per cent of Agency Chief Executive posts (7 out of 91) are now held by women. These include the heads of the Agricultural Development and Advisory Service and the Forensic Science Service.

THE RESEARCH COUNCILS

2.30 A similar story is told within the Research Councils. Despite the fact that women are well represented at junior levels, particularly in the biological sciences, only in the Medical Research Council do women exceed 10 per cent of staff at Grades 3-5[13]. There are very few women in senior decision- or policy-making positions. Similarly, the representation of women on the Councils themselves in 1992-93 was very small, and women were absent from the Advisory Board for the Research Councils (Figure 10). As part of the Civil Service's Programme of Action, the Research Councils have announced targets for improving this situation[14].

FIGURE 10 : NUMBERS OF MEN AND WOMEN ON THE RESEARCH COUNCILS AND THE ADVISORY BOARD OF THE RESEARCH COUNCILS, 1992



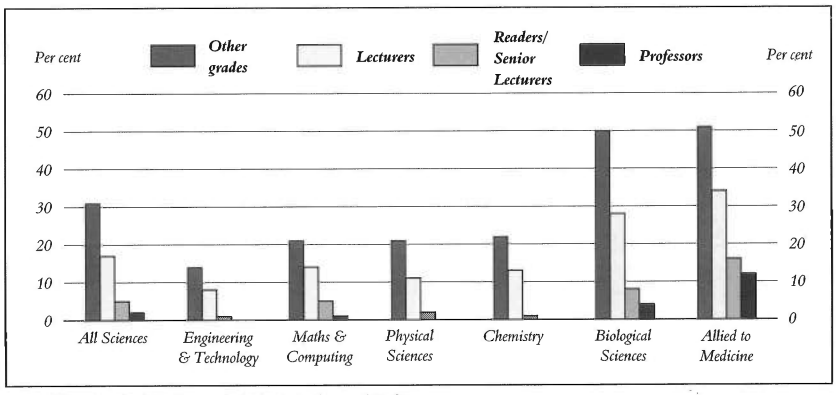
Source: OST Officials

ACADEMIC POSTS

2.31 Examination of the position within British universities in 1991 again demonstrates the serious under-representation of women in SET fields. Of the 24,000 full-time academic staff in the biological and physical sciences, chemistry, mathematics and computing, engineering and technology, and subjects allied to medicine, women accounted for only 15.5 per cent[15]. As in other sectors, this proportion falls away with increasing seniority (Figure 11) and the numbers of women at reader, senior lecturer or professorial level are extremely small. This holds true also for those subjects traditionally favoured by women. In the biological sciences only 22 out of nearly 500 professors are women.

2.32 The small proportion of women in senior positions has aroused serious concern, not least because of the lack of role models for women students to emulate. A further problem is the limited size of the pool from which higher appointments can be made. In response, the Committee of Vice-Chancellors and Principals (CVCP) has issued guidance on Equal Opportunities in Employment in Universities in 1991. This includes a recommendation that universities, where appropriate, take advantage of those sections of the *Sex Discrimination Act* 1975 which allow for positive action. The CVCP's new Commission on University Career Opportunity will promote equal opportunities for university staff.

FIGURE 11 : FULL-TIME WOMEN ACADEMIC STAFF IN UNIVERSITIES (EXCLUDING FORMER POLYTECHNICS) BY SUBJECT IN GREAT BRITAIN, 1991/92



Source: University Statistics Volume 1 1991-92, Students and Staff

WOMEN AT THE TOP

PUBLIC APPOINTMENTS

2.33 The scarcity of women in senior public appointments is documented in the 1990 Report *Women at the Top*[16] which considered the barriers to the advancement of women, including those in Parliament, public office, the Civil Service, the judiciary and legal profession, management, universities, trade unions and on boards of directors. For example, there is at the time of going to press only one woman Vice-Chancellor.

2.34 Table 4 illustrates the striking under-representation of women in public appointments on some of the key Councils and Boards responsible for developing policy in SET-related fields. Women make up only a small proportion of the total, and on Councils and Boards concerned with industry, innovation, manufacturing and science women are often not represented at all.

2.35 Information on suitable women candidates is available from the Public Appointments Unit (PAU) in the Cabinet Office, the Women's National

Commission and Women in Public Life[17]. These organisations are working to increase the pool of suitably qualified women and their appointment to public office, as are the Equal Opportunities Commission and the Fawcett Society, but are not, as yet, routinely consulted when public appointments are made.

2.36 In recent years some attention has been paid to the representation of women on the boards of holding companies, but numbers still remain low. In July 1993, of the UK's Financial Times Stock Exchange (FTSE) top 200 companies, 59 had one woman director on the board, of which 12 were executive. In 1992 the total number of women had been 28, on 21 boards, of which five were executive[18]. Out of the 1,370 Chief Executives of Britain's quoted companies in 1992, only five were women[19].

Table 4 : Public appointments of men and women to Councils and Boards in SET-related fields

	Men	*Women*	*Department*
Council for Science and Technology (CST)	11	1	OST
ACORD (Advisory Council on R&D)	8	0	DTI
Advanced Manufacturing Technology Committee	11	0	DTI
Information Technology Advisory Board	16	0	DTI
Innovation Advisory Board	12	0	DTI
Standards, Quality & Measurement Advisory Committee	13	0	DTI
Industrial Research & Technology Board	10	2	DED
Technology Foresight Steering Committee	11	0	OST
Education and Training			
Business & Technology Education Council	12	3	DFE
National Council for Educational Technology	11	8	DFE
National Council for Vocational Qualifications	12	0	DE
Higher Education Funding Council for England	11	2	DFE
Scottish Higher Education Funding Council	10	2	SO
Higher Education Funding Council for Wales	10	1	WO
Northern Ireland Higher Education Council	8	3	DENI
Museums, Libraries etc			
Natural History Museum	11	2	NH
Museum of Science & Industry in Manchester	12	3	NH
National Museum of Science & Industry	14	3	NH
Royal Botanic Gardens, Kew	9	3	MAFF
Royal Botanic Garden, Edinburgh	7	1	SO

	Men	*Women*	*Department*
Energy			
British Coal Corporation	10	0	DTI
Renewable Energy Advisory Committee	14	1	DTI
UKAEA	9	0	DTI
British Nuclear Fuels	11	1	DTI
Defence			
Defence Scientific Advisory Council & Committees	156	2	MOD
Meteorological Research Sub-Committee	8	0	MOD
Environment, Agriculture			
Royal Commission on Environmental Pollution	12	2	DOE
Countryside Commission	6	2	DOE
Joint Nature Conservation Committee	4	0	DOE
Scottish National Heritage	11	1	SO
Northern Ireland Council for Nature Conservation and the Countryside	12	8	DOE (NI)
Advisory Committee on Release of Genetically Modified Organisms to the Environment	17	3	DOE/HSE
Advisory Committee on Novel Foods and Processes	12	3	DOH
Building Regulations Advisory Committee	14	1	DOE
Northern Ireland Buildings Regulation Advisory Committee	17	1	DOE (NI)
Health			
National Food Survey Committee	4	1	MAFF
National Biological Standards Board	13	3	DoH
Standing Pharmaceutical Advisory Committee	10	2	DoH
Public Health Laboratory Service Board	18	1	DoH
Advisory Committee on NHS Drugs	11	4	DoH
Expert Advisory Group on AIDS	15	6	DoH
Human Fertilisation & Embryology Authority	10	11	DoH
Regional Health Authorities	62	20	NHS
Scottish Health Service Advisory Panel	16	2	SO
Welsh Medical Committee	19	2	WO
Welsh Scientific Advisory Committee	14	1	WO
Research Councils			
Agricultural & Food Research Council	21	1	OPSS
Medical Research Council	18	2	OPSS
Natural Environment Research Council	19	1	OPSS
Science & Engineering Research Council	17	2	OPSS
TOTAL	**799**	**118**	

Source : 'Public Bodies 1992', Cabinet Office (OPSS), 1993, HMSO.

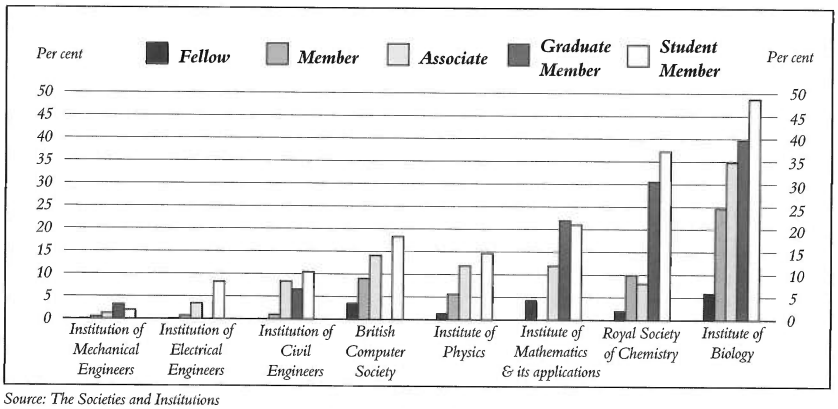
LEARNED SOCIETIES AND PROFESSIONAL ORGANISATIONS

2.37 Before the *Sex Discrimination (Removal) Act*, 1919, few learned societies and professional institutions admitted women. The proportion of women fellows and members of the societies and institutions has grown but very slowly.

2.38 The present distribution of women by class of membership of scientific societies and engineering institutions follows the familiar pattern (Figure 12). Women are less than 0.2 per cent of fellows or 1 per cent of members in the engineering institutions, though up to 10 per cent of student members. Women are 2 per cent or less of fellows in the Institute of Physics and the Royal Society of Chemistry, 3.6 per cent in the British Computer Society, 4.3 per cent in the Institute of Mathematics and 6 per cent in the Institute of Biology. It is recognised that this situation arises, but only in part, because of the limited pool of women within SET, and the low number who reach the senior positions in their professions. This reinforces the need to ensure real equality of opportunity for women at all stages of their career.

2.39 The Royal Society and the Royal Academy of Engineering represent achievement and influence in SET fields. The proportion of women Fellows of the Royal Society reached 3 per cent in the late 1960's and has remained at this level ever since. Only seven women (3.5 per cent of new Fellows) were elected in the five years 1989-93. The Royal Academy of Engineering has elected three women out of 901 British Fellows.

FIGURE 12 : WOMEN IN PROFESSIONAL INSTITUTIONS BY CLASS OF MEMBERSHIP, 1992



Source: The Societies and Institutions
The Institute of Physics, British Computer Society and Institute of Electrical Engineers do not have a 'Graduate Member' category and the Institute of Mathematics and its Applications does not have a 'Member category'.

INTERNATIONAL COMPARISONS

2.40 Most countries have now legislated for equal employment opportunities for women and equality policies for women in SET are beginning to emerge, notably in Canada and the USA. A brief review of women in SET in a number of countries, including the USA, Australia, New Zealand, Canada, Sweden and European Community (EC) member states, shows the general preference of women for biological rather than physical sciences and engineering. Despite local variations, few women rise to levels of seniority in SET in any country.

2.41 Many countries are now taking steps to address this issue. Of note is the work of the Canadian Committee on Women in Engineering, which was established in 1990 to improve the participation of women[20], and that of the Human Resources Committee of the National Advisory Board on Science and Technology which proposed action to remove barriers to women's participation in science and technology[21]. An action plan of Industry, Science and Technology Canada (ISTC) was initiated in 1993 to measure progress. It includes benchmarking and monitoring of the recruitment, retention and career advancement of women scientists, engineers and technologists in industry and educational institutions. In the USA, following the *Science and Technology Equal Opportunities Act* (1980), the National Science Foundation (NSF) has sponsored a range of programmes, including Visiting Professorships for Women, Research Planning Grants and Career Advancement Awards for women scientists and engineers. The NSF also monitors the progress of women and minorities in SET in a biennial publication.

2.42 A 1991 report, prepared under the auspices of the International Social Science Council, the Vienna Centre and United Nations Educational Scientific and Cultural Organisation (UNESCO), reviewed the position of women in SET in 12 European countries: Austria, Denmark, Finland, the Netherlands, Spain and Turkey, and from Eastern Europe, the former USSR, the German Democratic Republic (pre-unification), Hungary, Bulgaria and the former Yugoslavia[22]. The report describes the under-representation of women in SET fields in all these countries, particularly in senior positions. In countries such as those of Eastern Europe, (and including France) which have laid stress on equal access to education and employment in SET, with institutionalised childcare, the proportions of women scientists and engineers have increased substantially. Even in these countries, however, few women have reached senior positions in SET.

2.43 There is one key issue, that of the provision of publicly- funded childcare services, which is central to our concerns, and in which the UK is lagging behind the other European countries. The UK has publicly-funded

childcare services for 2 per cent of children under three, compared, for example, to 20 per cent in France and 48 per cent in Denmark. At ages three to compulsory school age, the UK provides such services for 35-40 per cent of children, compared with 95+ per cent in France and 85 per cent in Denmark (figures at 1988 for the UK and France, and 1989 for Denmark)[23]. We recognise that there are many factors which affect these figures, such as the age when compulsory schooling starts, and the level of privately-funded childcare available in different countries. Nonetheless, women in other European countries have the benefit of greater access to publicly funded childcare services than is available in the UK.

THE WAY FORWARD

3.1 There are a number of practical measures which could be taken to increase the contribution which women can make in SET. Realisation of the full potential of women in these fields will depend on long-term cultural changes in society, including changes in parental attitudes and a recognition that women's careers are no longer secondary. The implementation of good practice within the full range of education and by employers is needed not only to improve the short-term position, but also to encourage and expedite long-term change. Such changes would be of benefit both for employers and for the national economy, as well as for women themselves.

3.2 These issues are considered under the following headings: Education and Training; Employment; Women at the Top. The need for improved public awareness and understanding of SET and the contribution which women can make underpins these issues. A further section addresses the need for a higher public profile for the work of women in SET.

3.3 Central to the practical measures set out in the report is the recommendation that a Development Unit, under the auspices of the Office of Science and Technology, be established to take forward those recommendations which would benefit from action and coordination by a dedicated unit. The details of the Unit's functions are set out at the end of this chapter.

ENCOURAGING WOMEN TO STUDY SET : EDUCATION AND TRAINING

"It is damaging to UK society that women traditionally lead a minority role in science, engineering and technology at all levels. This must change. The best chance of change would be the broadening of post-16 education and giving more attention in teacher training to the development of inspirational skills in science, equally relevant to girls and boys of all ages."

Derek Roberts FRS, FEng Provost, University College, London

3.4 Modern society depends increasingly on technological competence and innovation. The need to attract more young people into SET is well recognised, to deploy specialist skills and also to be employed in all sectors of the UK economy. Success will depend, at least in part, on wider efforts to increase the attractiveness of these subjects to all students, including the greater participation by women.

SCHOOLS : GENERAL

3.5 All children need to acquire basic technical skills and some understanding of science. Science and engineering are often still perceived as 'masculine' subjects and the dominance of men in SET-related careers reinforces this stereotyped view. Such influences begin at home with parental attitudes and are strengthened by the educational process, peer pressure, and popular culture. The attitudes and behaviour of teachers are also especially important.

3.6 Some research studies have reported that girls perform better in science in single sex schools than in co-educational schools, however the evidence is variable. In any case, since most children are educated in co-educational schools there is a need to put in place methods of teaching science that suit girls as well as boys. More work is needed on presentation and teaching methods, and the content of courses to ensure that girls and boys are well-taught in science, mathematics and technology and have an equal opportunity to consider science or engineering as a career option.

3.7 Various modifications to the current arrangements are now being considered for curriculum content, examinations and testing in England and Wales (see also paragraph 2.3). We welcome the designation of science as well as mathematics as core subjects. We note that the options for slimming down the curriculum, proposed in the Dearing Interim Report[24], anticipate no change in technology being a compulsory subject to the age of 16. This may increase the numbers of 16 year olds choosing to continue to study science and technology subjects. It should also create an understanding that science and technology are integral components of education and lead, in due course, to a better awareness of science by the general public. The Northern Ireland curriculum also requires pupils to take a balanced science course and to study technology up to the age of 16. Curriculum guidelines for Scotland ensure that all young people up to the age of 16 study a science subject. The designation of science and mathematics as core subjects should continue to be supported. Attention should be given by the Education Departments to the quality of science and technology in schools and to ensure that teachers are fully qualified in these core subjects.

3.8 Technology is a key theme of the curriculum for 5-14 year olds in Scotland. Considerable improvements in the quality and quantity of science teaching are evident, to feed through to a more sustained uptake of science subjects at Higher level. There is also evidence to suggest that girls respond better to broad courses incorporating some elements of science rather than to very narrowly specialised science study on its own. (see paragraph 2.6).

3.9 Monitoring of the implementation of the National Curriculum from September, 1993 by OFSTED will be crucial. We acknowledge the inclusion of equality of opportunity as a factor for evaluation in the *"Framework for the Inspection of Schools"*[25] but believe it is essential that equal opportunities be given a high status throughout school life. Inspectors should report on good practice in teaching methods and general approach which result in more girls, as well as boys, being motivated to further study of science and technology.

3.10 We recommend that Government Education Departments and education and training establishments ensure that the initial and in-service training of teachers on equal opportunities issues includes guidance on means of maintaining the interest of girls as well as boys in all science subjects. We further recommend that OFSTED should routinely review the status and effectiveness of equal opportunities policies in schools.

THE TEACHING OF SET IN SCHOOLS

3.11 Science, engineering and technology are inherently exciting and challenging subjects. In their relation to the world around us, they are relevant to children from the earliest stages of their education and development. It is particularly important that children are introduced to SET at an early age in a way which captures their imagination and counteracts the traditional stereotyping which discourages girls from following careers in these fields. Committed, enthusiastic teachers, setting high academic standards and showing personal interest in science and in the future development of their pupils, are more likely to encourage pupils to continue education at a higher level in science and engineering, and to pursue careers in these disciplines. Interestingly, this has a disproportionately greater impact on girls and is an effective way of encouraging them to develop and maintain an interest in these subjects[26]. The presence of high calibre women in senior positions in schools is also valuable because they can influence school policy and provide role models.

3.12 Learning styles vary significantly at different ages and from individual to individual. The greater use of information technology in the interactive mode, computer-based learning or video systems, and other materials for independent learning could all be developed to help meet the challenge of accommodating these differences.

NURSERY SCHOOLS (AGE 3-5 YEARS)

3.13 Nursery schools give the opportunity for pre-school age children to develop their natural curiosity which gives them a head start in education. We

recognise the advantages of the use of play activities and learning materials which are not gender stereotyped in developing attitudes in small children. The provision of publicly-funded nursery education in the UK, which compares unfavourably with that in other EC member states (see paragraph 2.43), should be improved.

PRIMARY SCHOOLS
KEY STAGES 1 & 2
(AGE 5-7 & 7-11)

3.14 The recent inclusion of science as a core subject for primary schools is a positive step, which offers significant advantages for attracting young children to the subject at an early age and gives a sound basis for the more specialist approach of the secondary school. There are few primary school teachers in England who are science graduates. This is a matter of concern in a subject of key importance. We emphasise the need for many more primary school teachers with a sound knowledge of SET. Many primary schools have identified 'coordinators' with strengths in particular subjects who can assist and help train other staff. In Scotland a large proportion of women primary school teachers do have a science qualification and a significant number also have science-based degrees.

3.15 We welcome FE Circular 14/93 on 'The Initial Training of Primary School Teachers: New Criteria for Courses'[27] which requires that from 1 September, 1998 all new entrants to primary courses who were born on or after 1 September, 1979 must have attained the standard required to achieve a grade C in a science subject in the GCSE examination. We believe every possible step should be taken to raise this standard of qualification.

SECONDARY SCHOOLS
KEY STAGES 3 & 4
(AGE 11-14 & 14-16)

3.16 Career choices develop further during secondary education, so that teaching methods and appropriate careers advice become particularly important for children at this time. Between the ages of 14 and 16 pupils decide whether to continue with their education and choose their subjects for GCE 'A'level, National Vocational Qualifications (NVQs), General National Vocational Qualifications (GNVQs), or other types of further education. These choices have far-reaching effects on future careers. It is at this stage that children, and girls in particular, need sound information and encouragement if they are to consider science and engineering positively. All students are now expected to have at least two weeks of structured work experience before the age of 16. It would be advantageous for school children to have even greater contact with working scientists and engineers of both sexes.

3.17 A number of commendable initiatives exist (See Box 1) which seek to promote an understanding of SET in schools, and some of them address the problem of gender stereotyping. Other examples of good practice include schemes to introduce girls, as well as boys, to the relevance and excitement of science and engineering by visits to University Departments. The Training and Enterprise Councils (TECs) and Local Enterprise Companies (LECs) could also play a greater role in enabling girls to visit employers whose activities are science or engineering-based.

3.18 Extra-curricular activities and competitions (See Box 2) offer another important way of providing children with practical experience of the application of science and engineering. Youth groups concerned with environmental issues, and practical exhibitions for children, also stimulate scientific interest.

3.19 The careers advice offered to school children should emphasise the importance of SET in commerce and industry today, and avoid gender stereotyping. As part of good practice, careers advice should also involve parents, with the aim to increase their understanding of career options. Careers teachers should have the opportunity for work experience or shadowing placements in industry to improve their awareness so as to ensure relevant up-to-date advice on SET is targeted equally to girls and boys.

3.20 The system of careers guidance in Scottish schools is subject to more focused professional control and we are encouraged by this approach. Careers education programmes use visiting speakers from industry, commerce and the professions, and arrange work experience for all pupils. Careers officers also visit employers to keep abreast of scientific and technological developments, and their implications for jobs for school leavers.

3.21 *The Trade Union Reform and Employment Rights Act* 1993 widens the options for management of Careers Services and aims for local solutions for local needs. Involvement of local employers and organisations such as TECs and education providers aims to ensure delivery of high-quality careers advice within a framework that ensures impartiality and equality of opportunity. Careers Services will be obliged to develop an equal opportunities policy covering internal operations and client services, and monitor the effect of that policy. They must also ensure that their staff maintain a full and up-to-date appreciation of equal opportunities issues.

3.22 In England the Teacher Placement Service (TPS), with government support, has been particularly successful in organising exchange placements for teachers and people from industry. We welcome this two-way flow of

BOX 1 : COMMENDABLE INITIATIVES TO PROMOTE AN UNDERSTANDING OF SET IN SCHOOLS

These include:

THE ENGINEERING COUNCIL: OPENING WINDOWS ON ENGINEERING SCHEME[28]

THE ENGINEERING COUNCIL: NEIGHBOURHOOD ENGINEERS SCHEME[29]

ESSEX COUNTY COUNCIL: PARTNERS IN LEARNING SCHEME[30]

UNIVERSITY OF STRATHCLYDE: WOMEN INTO SCIENCE WORKSHOPS FOR SCHOOLGIRLS[31]

THE TECHNICAL VOCATIONAL EDUCATION INITIATIVE (TVEI)[32]

EDUCATION BUSINESS PARTNERSHIPS[33]

EDUCATION LIAISON SCHEMES OPERATED BY INDUSTRY

ENGINEERING TRAINING AUTHORITY INSIGHT SCHEME[34]

THE WISE (WOMEN INTO SCIENCE AND ENGINEERING) BUS SCHEME[35]

WOMEN'S ENGINEERING SOCIETY (WES): THE VERENA HOLMES LECTURE FUND AND VISITS OF WES MEMBERS TO SCHOOLS[36]

BOX 2 : COMMENDABLE EXTRA-CURRICULAR SET ACTIVITIES AND COMPETITIONS FOR SCHOOLS

These include:

THE ENGINEERING COUNCIL: YOUNG ENGINEER FOR BRITAIN[37]

YOUNG WOMEN ENGINEER OF THE YEAR[38]

YOUNG ENGINEERS[39]

THE CREATIVITY IN SCIENCE AND TECHNOLOGY (CREST) AWARD SCHEME[40]

THE ROYAL SOCIETY SCIENTIFIC RESEARCH IN SCHOOLS SCHEME[41]

THE BRITISH ASSOCIATION YOUTH SECTION (BAYS)[42]

AFTER-SCHOOL SCIENCE/ENGINEERING CLUBS

information and experience. 100,000 teachers have taken placements in industry through TPS since 1989[43]. In 1991/1992 around 40 per cent of teacher placements were in manufacturing and information technology related industry. Science and technology teachers also accounted for approximately 40 per cent of those undertaking placements.

SIXTH FORM EDUCATION

'A' LEVEL STUDY

3.23 In England, Wales and Northern Ireland the accepted academic route into careers in science and engineering has been to take GCE 'A'levels in 2, 3 or 4 science subjects in senior schools or sixth form colleges. The present 'A'level system has often been criticised, for instance by the Royal Society, the British Association for the Advancement of Science, the Confederation of British Industry (CBI), Heads of leading girls' schools, and by the Headmasters' Conference. The Dearing Interim Report proposes further consultation on this matter of broad educational policy. That aside, 'A'levels are considered by many to be too specialised, too limited, and divisive. They require young people to make decisions at an early age which may affect their future careers. We have noted that too few young people, particularly girls, are choosing to include sufficient science to continue the subject in higher education.

3.24 We recommend that, when reviewing post-GCSE courses in England, Northern Ireland and Wales, the Department for Education, the Department of Education for Northern Ireland and the Welsh Office Education Department should consider the advantages of a broader curriculum in encouraging more young people, particularly girls, to continue to study science beyond the age of 16, taking note of the Scottish experience. One widely supported proposal is for all pupils to take 5 subjects which should include at least one science subject and a foreign language. Less specialisation at this stage could encourage a greater number of able girls to continue in science. The improvement in the GCSE science results has shown that a change in educational structure can have a very significant effect. We are impressed by the operation of the Scottish Higher Education Certificate model which involves a wider range of subjects and, in contrast to England and Wales, has resulted in an increasing number of young people taking science and mathematics to higher education entrance standard over the past four years. We note that the International Baccalaureate model also covers a broad curriculum and has been adopted in some schools. Other proposals include the greater use of 'AS'levels, and combinations of academic and vocational qualifications. The broadening of school curricula will require compensatory adjustments in HE and funding.

HIGHER EDUCATION

3.25 Universities now have greater scope in assessing their admission requirements with a growing proportion of applicants offering combinations of GCE 'A'levels, 'AS'levels, 'Highers', GNVQs, NVQs, and other vocational qualifications, and of mixtures of science and arts subjects. We welcome the increasing flexibility shown by universities in their approach to entry qualifications. We look to them to develop this flexibility further.

3.26 All young people embarking on higher education have to adjust to new social pressures and competition within the lecture hall and the laboratory. Nevertheless, there are times when women studying SET can experience undue pressures, particularly in large classes where they may be in a small minority. If more young women are to be encouraged to go into SET in higher education, greater attention needs to be given to their development once they are there. This can include the provision of advice and mentoring by women staff and postdoctoral researchers. The SPRINGBOARD programme[44] has proved useful in building confidence and assertiveness in women in higher education, as well as in industry and professional life.

3.27 The development of bridging projects between industry and education and training institutions would help provide students with access to working women scientists and engineers who could act as mentors and role models. The greater liaison developing between higher educational establishments, the Research Councils and industry could be used to encourage such projects, which are increasing at school level but are not yet common in other educational establishments. The Women's Engineering Society model of partnering between higher education institutions and industry is a good example of how such schemes can succeed[45].

3.28 First degrees in SET can open the doors to many different types of career in administrative and research jobs in industry or public service. Women graduates should be advised on the career options so that they are given equal access to all schemes of funding for postgraduate training.

FURTHER EDUCATION

3.29 Further education colleges cater for a wide range of educational needs. They offer academic courses, work-based technical qualifications, higher technological qualifications, modular courses, 'access' courses for entry to higher education, and conversion courses for those wishing to change direction from arts to science or engineering degrees. Sandwich courses provide work experience and demonstrate the relevance of science and engineering in the

workplace. This broad spectrum provides opportunities for young people to develop work-related skills, or to move across into higher education, by building on their practical experience and qualifications. Such flexibility is of benefit to young women, particularly those who change direction or come to SET at a later stage.

3.30 GNVQs are now becoming available in further education institutions and in some schools. Science GNVQs are being piloted for introduction in 1994 and Engineering/Technology GNVQs are planned for 1995. Advanced GNVQs, the new 'vocational 'A'levels', are intended to be broadly equivalent to two GCE 'A'levels. We welcome the Standing Committee on University Entrance recommendation that Advanced GNVQs should serve as threshold qualifications for entry to higher education. This should provide a broad-based vocational pathway into higher education for those less suited to the traditional academic route.

3.31 In craft and technician courses the imbalance in numbers between men and women is often large. Gender stereotyping and experiences of isolation may present serious problems and we note this situation with concern.

KEY RECOMMENDATIONS FOR EDUCATION AND TRAINING

1. Government Education Departments and education and training establishments should ensure the initial and in-service training of teachers on equal opportunities issues includes guidance on means of maintaining the interest of girls as well as boys in all science subjects; The Office for Standards in Education (OFSTED) should routinely review the effectiveness of equal opportunities policies in schools (Paragraph 3.10).

2. When reviewing post-GCSE courses in England, Northern Ireland and Wales, the Department for Education, the Department of Education for Northern Ireland and the Welsh Office Education Department should consider the advantages of a broader curriculum in encouraging more young people, particularly girls, to continue to study science beyond the age of 16, taking note of the Scottish experience (Paragraph 3.24).

HELPING WOMEN TO STAY IN SET - EMPLOYMENT

"Gaining competitive edge in today's global markets demands continuing achievement of engineering, technological and scientific excellence. British Gas cherishes its reputation in this regard and recognises the contribution that women do - and, more so in the future, will - offer to the building of a diverse and competent workforce."

Robert Evans CBE, FEng Chairman, British Gas plc

3.32 Good management is about the effective use of resources, especially people. In SET, this is particularly important since the recruitment and training of highly qualified employees can be costly. Management practices which maximise the skills and potential of women, as well as men, benefit employers and employees alike.

EQUAL OPPORTUNITIES : GENERAL

3.33 We are convinced that equal opportunities policies must be part of an organisation's strategy. This strategy should cover practices relating to recruitment; job allocation; promotion; flexible working; mobility; training; development; family responsibilities; career breaks; parental leave and retraining. Line managers should be accountable for implementing these policies through the effective setting of targets and their regular monitoring.

3.34 It is well known that real commitment to equal opportunities is best achieved when there is leadership from the top. Heads of companies, Managing Directors and Chief Executives, University Vice-Chancellors, Directors of research organisations, and Heads of educational establishments all need to make their commitment explicit, and put in place appraisal systems which reflect this. The implementation of equal opportunities policies should be monitored and reported in Annual Reports.

EQUAL OPPORTUNITIES: EMPLOYMENT PRACTICE

3.35 Science and engineering employment continues to be a male-dominated world. Good equal opportunities practice therefore is becoming an increasingly important criterion when young people choose their place of employment. Employers should include their women scientists, engineers and technologists more prominently in publicity material, and in their promotion and recruitment procedures.

3.36 The selection processes for jobs recruitment in SET tend to be influenced by conventional career paths. In these circumstances qualified women who have followed atypical approaches may find it difficult to secure an interview to demonstrate their technical competence. Recruitment agencies should ensure that their selection processes do not disadvantage women scientists and engineers with atypical backgrounds and work experience.

3.37 Changing patterns and demands in the workplace, and the need to attract and retain skills in SET, make flexible working practices a cost-effective option. Employment contracts should embody good practice for staff on flexible terms of employment, including part-time working, job-sharing and flexible working hours, at all levels in SET. These arrangements can be extended effectively to senior as well as junior staff. We consider it important to seek to ensure that people on flexible terms of employment should be given comparable conditions in regard to performance pay; promotion; maternity and pension rights; access to training and other employment benefits available to full-time employees.

3.38 There is the probability that until such practices are more fully implemented, women too frequently will find themselves isolated in the workplace and at worst be at risk of sexual harassment. Employers should act positively to ensure that this does not happen, and that a harassment-free working environment be established through good management practices.

3.39 We noted several examples of good employment practice, and two initiatives in particular. 'Investors in People'[46] offers a national standard to encourage employers to invest more effectively in developing all their employees to achieve business objectives. There would be benefit in examining how best to build upon this standard and to explore the scope for giving recognition to effective management practices for women in SET occupations. 'Opportunity 2000'[47] has mounted a successful enrolment campaign to increase the quality and quantity of women's participation and advancement in the workforce. There may be scope to link with Opportunity 2000's proposed Education Sub-Committee, which will seek to address the particular issues faced by girls and women in education. We recommend that the Office of Science and Technology Development Unit work with 'Investors in People' and 'Opportunity 2000' to build on these initiatives to address the specific needs of women in SET.

3.40 Responses to the Working Group's questionnaire to companies provided further examples of current good practice. These included the development of comprehensive 'family friendly' policies; personal development plans for

women employees; 'keeping in touch' programmes for those on career breaks; 'tele-working' with home computer terminals and career support for those with caring responsibilities. Useful research into the recruitment and retention of women in science and engineering jobs across ten leading UK companies was published by the Policy Studies Institute in 1991[48]. This, and a 1990 study of women in engineering[49], identified good practice in a range of areas similar to those identified in the Working Group's questionnaire. We acknowledge the role played by the Equal Opportunities Commission in promoting good practice generally. We recommend that the Office of Science and Technology Development Unit initiate a series of pilot studies to identify and disseminate information on the economic and other benefits of existing women friendly management practices in SET.

CHILDCARE PROVISION

"Affordable childcare is essential for long-term economic growth"

Howard Davies Director-General, CBI

3.41 The combination of work and family responsibilities can pose problems for either parent, but because it has been usual for women to take the main responsibility for child-rearing it impacts most severely on them. Furthermore, the most common child-rearing period, when parents are aged between 25 and 35, often coincides with the time of key development in a science or engineering career. If young women can continue in employment at this stage of their career it will enable them to realise their full potential and provide the opportunity to progress to senior positions in SET. A key factor in achieving this will be the availability of affordable childcare and nursery provision (see paragraph 2.43).

3.42 Currently, companies may offset the cost of childcare facilities against corporation tax, and these facilities can be used tax-free by employees. This is a welcome provision but only partially addresses the problem. Few companies (mainly large ones) provide such facilities, and when they do not all employees may find them convenient because of their location or the age of the children concerned. A range of childcare options is needed to match the varied requirements of parents. We recommend that the Government should provide more publicly-funded and locally-available childcare services. The current lack of effective provision was stressed by Employers for Childcare earlier this year[50], and recently by the National Commission on Education[51].

3.43 To increase the availability of affordable childcare, we recommend that the Government should allow childcare costs to be claimable against employees' income tax, where both parents, or a single parent in a single parent family are

working. We believe that such tax relief is fundamental if the number of women able to undertake effective careers in SET is to improve. Our consultations revealed a consensus that this was a key action which would make a positive long-term impact on the issue.

TRAINING AND DEVELOPMENT

3.44 With the pace of technological change it is becoming increasingly important that staff receive regular training and updating of skills. Many large companies recognise the advantages of a skilled and motivated workforce and provide such in-service training. In line with good equal opportunity practices, such facilities should be readily available to all employees, including women. Employers should review their training provision and its flexibility to ensure that women are able to participate fully in SET training, with the opportunity to gain additional qualifications while in employment.

3.45 It is important therefore that strategies should also be in place to recognise and equip women with the necessary qualifications, inter-personal skills and experience for senior and board level positions. Career development plans should include provision for appropriate training and must include women, as well as men, in high profile projects and at senior level meetings. In this way, they will gain visibility and the opportunity to observe and interact with senior management. Placing women in pivotal positions, that is key leadership and management posts in institutions, companies or government appointments, is crucial. Senior managers should aim to have women included in the plans for succession to pivotal posts at every level, and should have targets for filling these positions with a reasonable percentage of women.

RETURNERS

3.46 Returners schemes are an important means of offering mature students flexible access to acquiring the skills and confidence which they need to return to employment. The difficulties which many women have found in returning to SET careers after a break cannot be underestimated. Those who return often find that the break has an adverse impact on their subsequent career progression. Arrangements for 'keeping in touch' during a career break are particularly important for women to remain aware of developments in their field. These arrangements can also be of benefit to employers. The case of absence through maternity leave is particularly important to women, who may prefer a phased return to work, gradually increasing their hours of work from part-time to full-time. Such flexibility must be adopted by employers if well qualified, highly-trained and experienced women in SET are not to be lost to the nation's workforce.

3.47 There are various facilities at local and national level for retraining and updating of women returners to SET. The broadest provision is that of the Open University, which offers a full range of courses, including mathematics, science and technology, by distance learning techniques. The Open University Women in Technology Returners Scheme[52] provides bursaries for women who wish to return to a career in science and technology, enabling them to enrol on courses in SET. We welcome this initiative.

3.48 In addition, an excellent national scheme for women returners is the Daphne Jackson Memorial Fellowships Trust[53], which became a charitable Trust in 1991. Over 30 Fellowships have been funded for qualified women engineers and scientists to retrain and update their skills following a career break. The part-time Fellowships are held at a university of the Fellow's choice, usually for two years and involve a significant research or development project.

3.49 Other notable schemes in the past have included the one provided by Hertfordshire TEC which contracted places with a local university for updating courses to encourage women science and engineering graduates back into research and development (R&D) or technician posts. EC funding has been used by Essex TEC for a BTEC foundation course in engineering for returners new to the subject. The Women Returners' Network[54] aims to facilitate women's re-entry into the labour force by promoting relevant education, training and employment opportunities. The Network also provides information to employers on the schemes available, with particular emphasis on flexibility and training provision.

3.50 The future of some of these successful schemes is being put in jeopardy because of fragmentary and insecure funding. We recommend that the Department of Employment should facilitate national support and funding for successful returners schemes for women in SET, to help secure the future of these schemes and enable greater numbers of potential women returners to take advantage of this type of training.

EQUAL OPPORTUNITIES IN RESEARCH

"The Royal Society believes that research opportunities should be made more flexible so as to meet the needs of mature students and those with family expectations and commitments."

Sir Michael Atiyah President, The Royal Society

3.51 The White Paper 'Realising our Potential' recognised that the current pattern of contract staff in universities and research institutes is a matter for concern. It looked to grant-giving bodies to adapt their arrangements to improve the career opportunities for research staff. The importance of this issue was stressed in our consultations.

3.52 We recommend that funding bodies should make research funding arrangements for principal investigators and research fellows more flexible, so that potential award holders are not disadvantaged if their mobility or availability for full-time work is restricted by family commitments. One valuable scheme would be to award 'portable' fellowships to individuals rather than to institutions so that the holder can choose his or her place of work. Age limits for fellowships could be replaced by the criterion of years of relevant experience. Extensions to the period of a fellowship or grant award for the purpose of maternity leave may need some increase in the award to cover additional costs. Flexibility over the length of the period of the research contract could allow research fellows to spread a three year grant over five years. Such flexible arrangements would be of particular benefit to women in SET. Examples of changing practice include the Royal Society University Research Fellowships and the fellowships offered by the Wellcome Trust. These, and other funding bodies, are seeking to increase the flexibility of their fellowships and we strongly support this approach. However provision needs to be extended since it is still limited and is often applied only to selected awards.

3.53 A 1993 EC International Workshop reported that the problems faced by women in SET research are remarkably similar throughout the Community, despite the clear economic and social differences between member states[55]. Common difficulties were reported of lack of access to research funds and entry into SET research, and low representation on decision-making bodies. We strongly support the view that future EC Programmes, including the Fourth Framework Programme, be used to promote equal opportunities for women in SET research.

REGIONAL CAREER DEVELOPMENT ADVICE

3.54 There are various reasons why women do not pursue their careers in SET. Some of these could be addressed if women had access to a SET-orientated regional service which advised on career development and the opportunities for flexibility in employment. Careers advice should be provided by professionals and be locally available to all. However the majority of current careers advisory services are aimed at 16-19 year olds, and adult career guidance is piecemeal. In particular, there is little career development advice for women

staff within academic establishments. As one university staff development and training officer noted: 'Women in SET are perceived as an invisible group in terms of directed career development advice and programmes.'

3.55 There are organisations providing advice on career development in SET and some examples of good practice, such as the Gateways to Learning networks[56] coordinated through the TECs and LECs, but these are patchy in availability. Government has also made vouchers available for assessment and guidance via the Skill Choice initiative[57] for those in employment or seeking work. However, we consider there is scope for a more coordinated service to address the needs of SET.

3.56 Such a service should seek to offer advice on the assessment of present skills, the development of realistic career choices, and the availability of flexible terms of employment, or signposting to where such advice could be obtained. Consideration could be given to widening provision to employers who may not have formal advisory mechanisms of their own. Maintaining contact with a number of employers, a service of this kind might also be able to act as a broker for identifying job opportunities within a particular region, given that immobility can be a serious bar to career progression. In the first instance it might take the form of an experimental service in a few regional centres in the UK to explore how such a service might be targeted. Following initial pump-priming by Government, it would be expected that the service would become self-financing.

3.57 We recommend that the Office of Science and Technology Development Unit, in consultation with the Department of Employment, examine the provision of a regional careers development advisory service in SET, building where possible on existing regional schemes and networks.

3.58 The Government's plan to bring together from April 1994 a range of programmes to support education, training and economic development under a unifying regional structure for England should enable more flexible support for enhancing job prospects, education and skills of local people, particularly those presently at a disadvantage.

3.59 Where networks exist for women in SET they can provide an important mechanism for people to maintain contact and can help with support and mentoring. They often, in the first instance, involve local contacts in an institution, or those nearby, and become progressively extended as a result of active participation in relevant professional societies. It has been suggested to us

that there would be an advantage in strengthening current network groups by linking their activities through the development of some form of 'Association' for women in SET.

EMPLOYMENT : KEY RECOMMENDATIONS

1. **Equal opportunities policies should be a recognised part of an organisation's or company's strategy. The implementation of these policies should be monitored and reported in Annual Reports (Paragraphs 3.33, 3.34).**

2. **The Office of Science and Technology Development Unit should work with 'Investors in People' and 'Opportunity 2000' to build on these initiatives to address the specific needs of women in SET (Paragraph 3.39).**

3. **The Office of Science and Technology should initiate a series of pilot studies to identify and disseminate information on the economic and other benefits of existing women friendly management practices in SET (Paragraph 3.40).**

4. **The Government should allow childcare costs to be claimable against employees' income tax, where both parents, or a single parent in single parent families, are working. In addition, the Government should increase the provision of publicly-funded childcare services (Paragraphs 3.42, 3.43).**

5. **The Department of Employment should facilitate national support and funding for successful returners schemes for women in SET, to help secure the future of these schemes and enable greater numbers of potential women returners to take advantage of this type of training (Paragraph 3.50).**

6. **Funding bodies should make research funding arrangements for principal investigators and research fellows more flexible so that potential award holders are not disadvantaged if their mobility or availability for full-time work is restricted by family commitments. The Government's Annual Forward Look of Science and Technology should provide information on the extent to which the Research Councils are addressing this issue (Paragraph 3.52).**

7. The Office of Science and Technology Development Unit, in consultation with the Department of Employment, should examine the provision of a regional careers development advisory service in SET, building where possible on existing regional schemes and networks (Paragraph 3.57).

SCALING THE HEIGHTS : WOMEN AT THE TOP

"For too long the potential of women has been ignored. This failure to capitalise on a vast pool of talent must be reversed, both attitudinal and structural barriers need to be addressed. One of the key principles of the Opportunity 2000 campaign is that organisations make a positive commitment to set challenging and measurable goals, and that they agree to monitor, review and publicly report on progress."

Lady Howe Chairman, Opportunity 2000

3.60 Women are seriously under-represented in senior positions, including appointments as chairmen, on influential boards and public bodies or committees responsible for developing and managing policy on science and engineering, and in employment generally. Policy decisions and future planning in research, training and the management of industry will retain their male ethos as long as the responsible bodies continue to be chaired by men and most of the membership is male. The appointment of more women to decision-making positions will bring a greater diversity of experience, of skills, and of outlook.

3.61 The underlying reasons for the low representation of women on boards or in public appointments are varied, and often cultural. Many women are 'invisible' to selection panels who may recognise only known 'names' or people put forward by known names. Advice is often sought from industry and the universities, and the dearth of women on company boards and in the professoriate is a particular disadvantage. Some women, who have followed non-standard career paths because of family responsibilities, are unable to meet pre-defined criteria based on age or status despite having the skills and ability to do the job well. The Women's National Commission has a policy to encourage more women to apply to be members of publicly appointed bodies, and should perhaps expand its activities. The drive for such action should not solely be to achieve targets but to widen the talent base from which top people are selected.

3.62 Mechanisms for identifying suitable women candidates are limited. The PAU within the Office of Public Service and Science holds a database of around 5000 names covering all specialisms, and professional organisations hold

databases of their members. The Committee for the Public Understanding of Science (COPUS) has a database for potential speakers on science and engineering. We recommend that employers and professional institutions should set up and maintain their own databases and networks of women scientists and engineers qualified for appointment to their boards and committees, or for nomination to public appointments. A central catalogue of databases should be held by the Office of Science and Technology, and updated annually, to disseminate this information.

3.63 To increase numbers of women in senior positions and on policy-making bodies, meaningful targets have to be in place which can be reviewed and monitored effectively. The Chancellor of the Duchy of Lancaster has given a lead in this context by setting a target for 15 per cent women by the year 2000 in the top three grades of the Civil Service, where there are currently only 3.4 per cent in senior SET positions. The Government has also set targets by Department to increase the number of public appointments held by women, and to improve representation of women on the Research Councils[58]. We recommend that a similar approach be adopted by other institutions including Universities, research institutes and industry. We would welcome the implementation of the Government's commitment, particularly in SET, to appoint substantially more women to serve on and chair public bodies. We note the recommendations of the Cabinet Office's *Career Management and Succession Planning Study* that the Senior Appointments Selection Committee should include at least one woman member and that the Head of the Home Civil Service should appoint a senior equal opportunities adviser or advisory panel[59].

WOMEN AT THE TOP : KEY RECOMMENDATIONS

1. Employers and professional institutions should set up and maintain their own databases and networks of women scientists and engineers qualified for appointment to their boards and committees, or for nomination to public appointments. A central catalogue of databases should be held by the Office of Science and Technology, and updated annually, to disseminate this information (Paragraph 3.62).

2. Government Departments and other employers should set targets specifically for all public appointments and senior positions in SET, including chairmanships, of at least 25 per cent qualified women by no later than the year 2000. (Paragraph 3.63).

LOOK UP : A HIGHER PUBLIC PROFILE FOR WOMEN IN SET

3.64 The image and status of scientists, engineers and technologists are strongly influenced by the media. Better coverage is needed of the essential and beneficial part which SET plays in all aspects of modern life. Women scientists, engineers and technologists should have a higher, more positive, public profile, so that their achievements are more widely recognised.

3.65 The influence of the media is particularly important for the perception of SET by children, and the image of women scientists and engineers portrayed by the media is critical. The limited coverage of science and engineering in general, combined with the stereotyped views presented through television, videos, advertisements, the press, the commercial promotion of toys, and other aspects of popular culture which children encounter in their formative years, currently does little to enhance this image.

3.66 The White Paper 'Realising Our Potential' recognises that a number of organisations such as COPUS (sponsored by the British Association for the Advancement of Science, the Royal Society, and the Royal Institution), the British Association for the Advancement of Science, the Engineering Council, and learned societies and professional institutions have actively stimulated public interest in science and engineering. These activities include magazines, courses, book prizes, awards and media fellowships. One year Master of Science (MSc) courses in science and engineering communication are also available to train scientists and engineers in popular science journalism.

3.67 Such schemes play an important role in demonstrating that science and engineering can be accessible and relevant to everyday life and affairs, as well as being fundamental to the development of our future. All organisations and bodies with an interest in raising general understanding and awareness of SET and the contribution which women make have a part to play in encouraging greater and more responsible media coverage of these issues. Of particular importance will be the influence of the professional institutions and associations, a number of whom already undertake valuable public awareness activities. Major employers and Government Departments also have a key role. We recommend that further action is taken to address the fact that the media focus only occasionally on the part which women play in these fields, and rarely depict women in science and engineering jobs as a normal occurrence.

A HIGHER PUBLIC PROFILE FOR WOMEN IN SET : KEY RECOMMENDATION

The Office of Science and Technology should further develop its strategy for promoting public awareness and maintaining contact with media outlets, and should encourage coverage of the contribution women make to SET (Paragraph 3.67).

FOCUSING ON THE FUTURE

A DEVELOPMENT UNIT

3.68 In paragraph 3.3, we indicated the need for a Development Unit to take forward those recommendations which would benefit from action and coordination by a dedicated unit. We recommend therefore that a Development Unit should be established under the auspices of the Office of Science and Technology for an initial three year period. Its function should be as follows:

i. To work with 'Investors in People' and 'Opportunity 2000' to build on these initiatives to address the specific needs of women in SET (paragraph 3.39).

ii. To initiate a series of pilot studies to identify the economic and other benefits of women-friendly management practices in SET, and to disseminate information on these in collaboration with industry, and the public and private SET sectors (paragraph 3.40).

iii. To commission an appraisal to inform an analysis of the tax implications of allowing childcare expenses to be offset against employees' income tax, where both parents, or a single parent in single parent families, are working. A report to Ministers should be completed before the end of 1994 (paragraph 3.43).

iv. To establish, in consultation with the Department of Employment, an experimental careers advisory service in a few regions of the UK, building upon existing schemes and networks. Such a service will provide women with access to SET skills assessment and careers advice (paragraph 3.57).

v. To work with employers, learned institutions and professional bodies, the PAU, and the Department of Trade and Industry and the CBI to encourage the establishment and maintenance of databases and networks of women in SET, and to prepare a central catalogue of these databases (paragraph 3.62).

vi. To promote contact with media outlets, in order to raise public awareness of the contribution women make to SET (paragraph 3.67).

vii. To keep under review, progress made on the report's recommendations, and to report on output measures for monitoring their implementation to the Chancellor of the Duchy of Lancaster.

MONITORING ACTIVITY

3.69 The recommendations in this report will benefit from overall consideration and advice on their implementation. We therefore recommend that the Council for Science and Technology be invited to consider this report.

FOCUSING ON THE FUTURE :

KEY RECOMMENDATIONS

1. A Development Unit should be established under the auspices of the Office of Science and Technology for an initial three year period to take forward those recommendations which would benefit from action and coordination by a dedicated unit (paragraph 3.68).

2. The Council for Science and Technology should be invited to consider this report (paragraph 3.69).

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27. "The Initial Training of Primary School Teachers: New Criteria for Course Appraisal", Department for Education, 1993.
28. Opening Windows on Engineering Scheme - engineers visit schools to talk to 12 to 15 year olds about their jobs. The Engineering Council, 10 Maltravers Street, London WC2R 3ER.
29. Neighbourhood Engineers Scheme - three or four engineers are linked with a local secondary school to offer practical support to teachers. The Engineering Council address as above.
30. Essex County Council Partners in Learning Scheme - encompasses various projects that encourage partnerships between schools and companies, particularly in areas where there are skills shortages, including engineering, science, electronics and information technology. Essex Careers and Business Partnership, Partners in Learning, c/o Colchester Careers Centre, Centurion House, St John's Street, Colchester CO2 7AH.
31. Women into Science Workshops for Schoolgirls - University of Strathclyde "Women into Science" Committee runs annual summer workshops for schoolgirls to provide them with the opportunity to meet women scientists and students, and to experience experimental science in university laboratories. Convener, "Women in Science" Committee, Faculty of Science, University of Strathclyde, Royal College, 204 George Street, Glasgow, G1 1XW.
32. The Technical Vocational Education Initiative (TVEI) - relates education to the world of work for 14 to 18 year olds. Employment Department, Moorfoot, Sheffield S1 4PQ.
33. Education Business Partnerships coordinate a broad range of activities to help young people achieve their potential, including SET/industry awareness events for girls, and the promotion of non-stereotyped attitudes and opportunities. Partnerships Unit, Room E451, Employment Department, Moorfoot, Sheffield S1 4PQ.
34. Insight Scheme - residential visits for school children to university science and engineering departments. The Engineering Training Authority, Vector House, 41 Clarendon Road, Watford, Herts WD1 1HS.
35. Women Into Science and Engineering (WISE) - six WISE buses may be borrowed by Local Education Authorities and schools to support activities showing 13 to 14 year old girls and their parents the roles and opportunities available for women in science and engineering. The Engineering Council, address as above.
36. The Women's Engineering Society, Imperial College of Science, Technology and Medicine, Department of Civil Engineering, Imperial College Road, London, SW7 2BU.
37. Young Engineer for Britain - a competition open to both sexes with a WISE award for the best entry from a girl. The Engineering Council, address as above.
38. Young Women Engineer of the Year - award by the Institution of Electronic and Electrical Incorporated Engineers and the Caroline Haslett Memorial Trust. The Trust also offers bursaries to young girls and older women returners studying in electronic, electrical and allied engineering subjects. IEEIE, Savoy Hill House, Savoy Hill, London, WC2R 0BS.
39. Young Engineers - clubs based in schools and colleges where students tackle real life projects with designers and engineers. Visits to companies, and national awards and certificates. Young Engineers, c/o Biwater Court, Station Approach, Dorking, Surrey RH4 1TZ.

40. Creativity in Science and Technology (CREST) Award Scheme -links schools with practising scientists at regional level. CREST supports teachers and students, providing recognition between the curriculum and NVQs. CREST Awards, Surrey Technology Centre, University of Surrey Research Park, Guildford, Surrey GU2 5YH.
41. Royal Society Scientific Research in Schools - enables teachers and pupils to participate in original scientific research in schools through practical and experimental projects. The Royal Society, 6 Carlton House Terrace, London SW1Y 5AG.
42. British Association Youth Section supports schools and youth groups with worksheets, information packs and competitions for under 10's, under 13's and 13 to 18 year olds. BAYS, Fortress House, 23 Savile Row, London W1X 1AB.
43. Department of Employment Press Notice, No 208/93, 18 October 1993.
44. SPRINGBOARD is a self-development training programme to help women identify and develop their strengths and abilities. SPRINGBOARD, PO Box 69, Stroud, Gloucester GL5 5EE.
45. Women's Engineering Society (Southampton) Bursary Scheme, c/o Faculty of Engineering and Applied Science, The University, Southampton SO9 5NH.
46. Investors in People UK, Department of Employment, Room N805, Moorfoot, Sheffield.
47. Opportunity 2000, 8 Stratton Street, London W1X 5SD.
48. "Women into Engineering and Science: Employers Policies and Practises" Susan McRae, Fiona Devine and Jane Lakey, Policy Studies Institute, London. 1990.
49. "Women in Engineering: A good place to be?" Ruth Carter and Gill Kirkup, MacMillan, London 1990.
50. "Good childcare, good business". Employers for Childcare, Priory House, 8 Battersea Park Road, London SW8 4BG.
51. "Learning to Succeed", National Commission on Education, London: Heinemann, November 1993.
52. Women in Technology Returners Scheme, The Open University, Fairfax House, Merrion Street, Leeds LS2 8JU; for other courses, The Open University, Walton Hall, Milton Keynes MK7 6AA.
53. Daphne Jackson Memorial Fellowship Trust, Department of Physics, University of Surrey, Guildford, Surrey, GU2 5XH.
54. The Women Returners Network, 8 John Adam Street, London WC2N 6EZ.
55. "Women in Scientific/Technical Research" - recommendations of an international workshop organised by the Commission of the European Communities Directorate General for Science, Research and Development. Brussels, February 15-16 1993.
56. Gateways to Learning. For details contact your local Training and Enterprise Council (TEC) or Local Enterprise Council (LEC), or Employment Department, ALC4, Room N904, Moorfoot, Sheffield S1 4PQ.
57. Skills Choice Initiative - For details contact your local Training and Enterprise Council (TEC) or Local Enterprise Council (LEC).
58. "Public Appointments and Equal Opportunities", Cabinet Office (Office of Public Service and Science), November 1992.
59. "Career Management and Succession Planning Study", Efficiency Unit, Cabinet Office, November 1993, HMSO.

ANNEX A

ORGANISATIONS CONSULTED

The Committee and Working Group has been appreciative of the help and information received from various Government Departments, British embassies and consulates, and the organisations listed below. The Committee and Working Group are also grateful to those who attended the meetings convened with women scientists and engineers at the Royal Society on 28 May 1993, and with women engineers at British Gas on 23 August 1993.

Amalgamated Engineering and Electrical Union
Agricultural and Food Research Council (AFRC)
Association of University Teachers
Biochemical Society
Bristol University
British Association for the Advancement of Science (BAAS)
British Association Youth Section (BAYS)
British Computer Society
British Women in Neuroscience
Business and Technology Education Council (BTEC)
Cambridge Laboratory (AFRC)
Cambridge Women in Astronomy
Careers Research and Advisory Centre (CRAC)
Chemical and Biological Defence Establishment
Chemical Industries Association
Confederation of Health Service Employees (COHSE)
Committee on the Public Understanding of Science (COPUS)
Confederation of British Industry (CBI)
Council of Science and Technology Institutes (CSTI)
Creativity in Science and Technology (CREST)
Committee of Vice-Chancellors and Principals (CVCP)
Daphne Jackson Memorial Fellowship Trust
Edinburgh Women's Science Forum
Employers for Childcare
Engineering Council
Engineering Training Authority
EPIC Europe
Equal Opportunities Commission
European Commission
Essex County Council
Fawcett Society
Gender and Science and Technology (GASAT)

Imperial College of Science, Technology and Medicine
Institute of Biology
Institute of Mathematics and its Applications
Institute of Physics, Women in Physics Committee
Institution of Electrical Engineers
Institution of Electronics and Electrical Incorporated Engineers
Institution of Mechanical Engineers
Institution of Professionals, Managers and Specialists
International Communications for Management
Investors in People
Laing Technology Group Ltd
Medical Research Council (MRC)
Medical Women's Federation
Mostly Movies Ltd
Natural Environment Research Council (NERC)
National Communications Union
National Council for Educational Technology
National Council for Vocational Qualifications
National Council of Women of Great Britain
National Health Service Management Executive
National Union of Rail, Maritime and Transport Workers (RMT)
Open University
Opportunity 2000
Royal Academy of Engineering
Royal Astronomical Society
Royal Society
Royal Society of Chemistry, Women Chemists Committee
Science and Engineering Policy Studies Unit (SEPSU)
Science and Engineering Research Council (SERC)
Science Policy Support Group
Soroptimist International of Great Britain and Ireland
Spencer Stuart
SPRINGBOARD
UK Federation of Business and Professional Women
University of Cambridge Dept of Applied and Theoretical Physics (DAMPT)
University of North London - Women into Architecture and Building
Universities Statistical Record
Women as Role Models (WARM)
Women's Engineering Society
Women, Heritage and Museums (WHAM)
Women in Computing
Women in Management
Women in Medicine

Women in Neuroscience
Women in Science at Cambridge
Women in Technology and Science (WITS)
Women in Technology in the European Community (WITEC)
Women in Public Life
Women into Information Technology (WIT) Foundation
Women into Science and Engineering (WISE)
Womens' National Commission (WNC)
Women Returners Network
Women Scientists and Engineers in Scotland
Young Engineers

ANNEX B

COMPANIES RESPONDING TO CONSULTATION QUESTIONNAIRE

As part of the Working Group's consultation, a questionnaire was circulated to companies asking about disposition by grade or seniority of their women staff, links with schools, colleges and universities, and their family friendly and equal opportunities policies. The Committee and Working Group are grateful to the following companies who responded:

AEA Technology
Amersham International plc
BICC Group Ltd
Boots Company
British Bio-technology Ltd
British Gas plc
BP Exploration
British Railways
British Steel
Cable and Wireless
(Mercury Communications)
ESSO
Ferranti International plc
GEC Alstrom ESL
Glaxo Group Research Ltd
Hickson Fine Chemicals
IBM UK Laboratories, Hursley
IBM UK
Logica
LWT
Lucas
National Grid Company plc
NORWEB plc
Nuclear Electric
Ove Arup and Partners
Pfizer Ltd
Pirelli Cables Ltd
Powergen plc
Rolls-Royce plc
Scottish Hydroelectric Ltd
Scottish Nuclear Ltd
Scottish Power
Seeboard plc
Sir William Halcrow and Partners
Smith and Nephew plc
SmithKline Beecham Pharmaceuticals
South Wales Electricity plc
Texaco Ltd
Wellcome Foundation
ZENECA

GLOSSARY

'A' level	-	Advanced level
'AS' level	-	Advanced supplementary level
BAYS	-	British Association Youth
BTEC	-	Business and Technology Education Council
CBI	-	Confederation of British Industry
COPUS	-	Committee on the Public Understanding of Science
CREST	-	Creativity in Science and Technology
CSE	-	Certificate of Secondary Education
CVCP	-	Committee of Vice-Chancellors and Principals
DFE	-	Department for Education
EC	-	European Community
FE	-	Further Education
FTSE	-	Financial Times Stock Exchange
GCSE	-	General Certificate of Secondary Education
GNVQ	-	General National Vocational Qualification
HE	-	Higher Education
LEC	-	Local Enterprise Council
MSc	-	Master of Science
NVQ	-	National Vocational Qualification
OFSTED	-	Office for Standards in Education
'O' level	-	Ordinary Level
OST	-	Office of Science and Technology
PAU	-	Public Appointments Unit
R&D	-	Research and Development
RSA	-	Royal Society of Arts Examinations Board
SCE	-	Scottish Certificate of Education
SET	-	Science, Engineering and Technology
TEC	-	Training and Enterprise Council
TPS	-	Teacher Placement Scheme
TVEI	-	Technical Vocational Education Initiative
WES	-	Women's Engineering Society
WISE	-	Women into Science and Engineering