Women in science : attitudes of university students towards a career in research : a pilot study / M. O'Driscoll and J. Anderson.

Women in science

Attitudes of university students towards a career in research: a pilot study

PRISM
Unit for Policy Research in Science and Medicine

WOMEN IN SCIENCE

Attitudes of university students towards a career in research: a pilot study

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M O'Driscoll and J Anderson

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This report presents the findings of a pilot study looking at the attitudes of women undergraduates and postgraduates to research careers in science.

The field work was carried out by Richard Wakeford (Adviser in Staff Development to Cambridge University Committee on the Development and Training of University Teachers), Jenny Harwood (Jenny Harwood Associates, London) and Claudia Downing (graduate student in Social and Political Sciences, Cambridge University).

We are very grateful to the staff and students in the departments of Biochemistry and Physics at the Universities of Leeds and Cambridge where the field work was conducted, with particular thanks to Professor Howie (Department of Physics, Cambridge), Professor Perham (Department of Biochemistry, Cambridge) Professor Batchelder (Department of Physics, Leeds) and Professor Wood (Department of Biochemistry, Leeds). Thanks also to Dr Wendy Ewart, Dr Mary Phillips and Dr Grant Lewison at the Wellcome Trust and to all the organizations and individuals who provided information.

Women are under-represented in senior scientific research positions. Of the 24 000 full-time academic staff in the sciences, mathematics, computing, engineering and technology, women accounted for only 15.5% in 1991.[1] The past year has seen a surge of interest in this issue culminating in a report published by the Committee on Women in Science, Engineering and Technology[2] which set out a number of recommendations aimed at improving the situation.

Despite this activity, very little systematic research has been conducted on the reasons behind the dearth of women in science. The study reported here sought to go beyond the anecdotal and question the attitudes of women science undergraduates and postgraduates to their choice of subject, to scientific research generally and to careers in research. As a short scoping study, it represents a provisional look at the issues, rather than an in depth analysis. The study was confined to two universities, Leeds and Cambridge, and two disciplines within those, namely physics and biochemistry. It took the form of structured, face-to-face interviews of undergraduates and postgraduates, supplemented by a questionnaire survey. In total, 47 women were interviewed. The questionnaire was completed by 130 students, half of whom were men.

The key findings are:

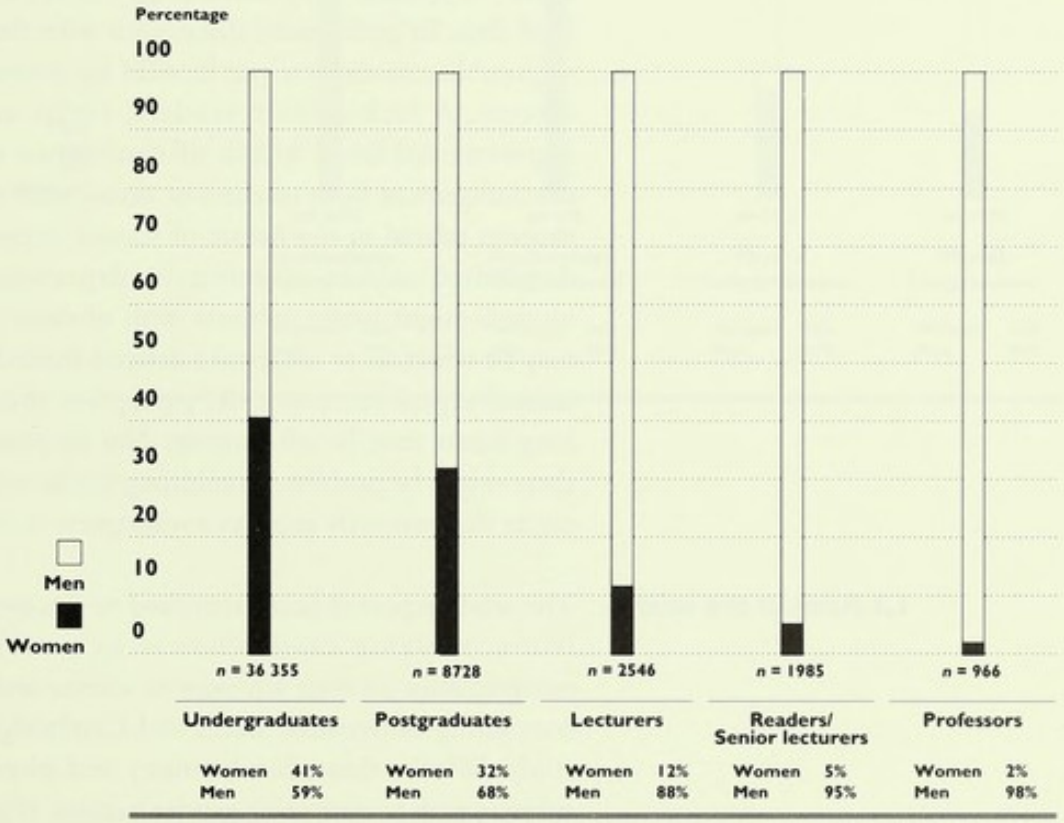
- Women were more likely than men to believe that scientists' working hours were excessive.
- An important factor in encouraging women to take up careers in research was a stimulating first degree course.
- The culture surrounding academic research was perceived by women as unattractive.
- Women were more likely than men to want to work in areas that involved contact with people.
- Women were less willing than men to undertake research that was defence funded or involved animal experimentation.
- There was some evidence that women would prefer to work in areas with clear, practical applications.
- Contrary to current belief, most of the women did not attach importance to female role models at university.

A number of suggestions were made for ways in which funding bodies and universities could improve their policies. Recommendations included the introduction of flexible working patterns and career breaks, the provision of expenses towards childcare costs and support for women on career breaks. Universities should consider monitoring the gender balance of courses and reviewing their approaches to teaching and to course content.

1.1 Background to the study

In 1992, women made up only 22% of all academic staff* in the UK and less than 16% in science departments.[1] Although earlier data are difficult to obtain, there is little evidence that the situation is improving. Furthermore, most women are concentrated in junior grades, with fewer than 3% advancing to professorial level (figure 1). Growing concern about this imbalance culminated last year in the establishment by the Office of Public Service and Science of a Committee on Women in Science, Engineering and Technology. Its recent report, The Rising Tide,[2] made a number of recommendations on education and employment aimed at increasing the numbers of women in science.

Figure 1 **Personnel in universities – physical and biological sciences 1992–1993 (data from Ref.1)**



Source: University Statistics 1992–93. Volume 1. Universities Statistical Record

Despite this, there is very little current research addressing the question of why so few women succeed in science, and much of the debate is based on anecdotal evidence. By exploring the attitudes of women undergraduates and postgraduates to science, research and future careers, this study aimed to highlight factors that may be dissuading women from entering a science career and where appropriate, to make recommendations for the Wellcome Trust and other funding bodies. The study took the form of structured interviews and, a questionnaire survey to characterize the attitudes of undergraduates and postgraduates who are in a position to consider a career in science.

* *Wholly university funded ('old' universities)*

1.2 Previous research

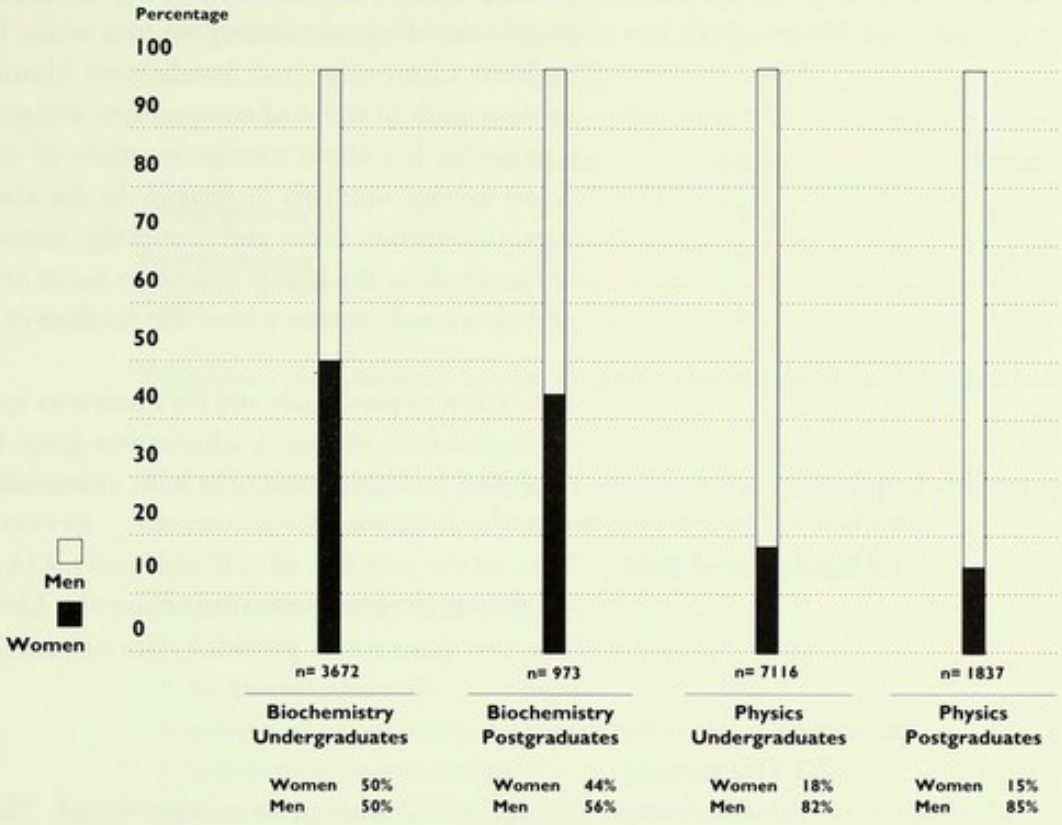
A review of recent literature revealed very little previous or ongoing research on the problems faced by women in science. The most relevant study, carried out by Thomas in 1990,[3] looked at the relationship between gender and subject choice in higher education, focusing in particular on English and physics. Arguing that students made their choice of subject on the basis of the qualities that these subjects are seen to hold, she suggested that men faced less of a conflict between their sense of identity and their subject of study. With men accounting for the majority of all academic staff, the prevailing ethos of academia, whether in the arts or the sciences, was to the advantage of men rather than women.

Discussions with several organizations involved in promoting women in science (appendix 1) revealed plenty of opinions but little in the way of hard data. In preliminary discussions with these organizations, a number of possible reasons were put forward for women's failure to pursue science careers. A lack of role models, sexist attitudes at university or departmental level, a lack of confidence among women and active discouragement from teachers or tutors were thought to be factors. Other theories related to the nature of science research and the perceived male-dominated culture of university departments. It was suggested that women might prefer subjects with obvious practical applications; they may be reluctant to undertake defence-funded work or research involving animal experimentation; the perception that research involves working long hours may be off-putting. Not surprisingly, many suggested that there might be problems combining family commitments with a scientific career that routinely requires a willingness to move job.

1.3 Aims of the study

The study reported here attempted to uncover the extent to which these issues influence career choices by surveying undergraduates and postgraduates on their attitudes to science and to careers in research. Two contrasting universities, Leeds and Cambridge, were chosen for the field study. Within these, biochemistry and physics were chosen as science subjects with a contrasting gender balance. (figure 2).

Figure 2 **Proportion of men and women in biochemistry and physics in UK universities 1992–1993 (data from Ref. 1)**



2.1 Choosing the subjects and the universities

Physics and biochemistry were chosen as subjects with a contrasting gender intake. Of all the science subjects, physics has the lowest proportion of women undergraduates whilst biochemistry has one of the highest. Cambridge and Leeds were identified as providing a good contrast both in terms of environment and gender balance. For example, Cambridge has above average numbers of women in biochemistry and below average numbers in physics. In the absence of data for any of the 'new' universities, Leeds and Cambridge cannot be taken as representative of the whole of the higher education sector in the UK. Nevertheless, they provide a good contrast within the confines of the older universities.

Agreement to participate and for interviews to be undertaken with women undergraduates and postgraduates was given by the heads of department of physics and biochemistry in both universities.

2.2 Background data

Data on the numbers of staff and students in physics and biochemistry at a national level were obtained from the Universities Statistical Record. The two universities provided data on the numbers of women in each year.

2.3 The sample

Interviews

A total of 47 women were interviewed. The breakdown according to status and subject was:

	Undergraduates	Postgraduates	Total
Leeds	9	22*	31
Cambridge	9	7	16
Total	18	29	47

** Including three postdoctoral scientists*

	Biochemistry	Physics	Total
Leeds	16	15	31
Cambridge	9	7	16
Total	25	22	47

Questionnaire survey

All 47 interviewees completed a questionnaire. A further 83 students, who were not interviewed, also completed the questionnaire, so the total questionnaire sample was 130. This was disaggregated by subgroup as follows:

	Women	Men	Total
Undergraduates	39	62	101
Postgraduates	29	0*	29
Total	68	62	130

* *All comparisons between the men and the women were made at the undergraduate level.*

2.4 Interview and questionnaire survey

The questionnaire and interview protocol were developed following discussions with science funding managers and policy analysts.

The interview protocol covered:

- the reasons for the study
- review of critical incidents and influences with respect to career choice
- completion of the questionnaire
- other relevant issues such as the importance of the number of women in the department; sexual harassment; what constitutes encouragement/discouragement
- discussing respondent's background and why they chose to study science
- career plans

A copy of the interview protocol may be found in appendix 2.

Full details of the results from the interviews and the questionnaire survey can be found in appendix 3. The following section outlines the essential findings.

3.1 Structure of the courses at Leeds and Cambridge

Leeds and Cambridge provided a contrast, not only in environment, but also in the structure of their courses.

Most students from Cambridge were taking the Natural Sciences Tripos. This offers students considerable choice and flexibility. From some 16 broad subject areas, students select a number of courses for each of their first and second years; a single subject is then chosen for the final year.

At Leeds, the course structure is less flexible. Students select one subject in their first year and study it through to third year. Transfer from one subject to another is rare.

In the academic year 1993/94, the percentage of women and (in brackets) the total numbers of students on each of the two courses were:

Biochemistry	**Year 1**	**Year 2**	**Year 3**
Leeds	35% (84)	38% (63)	34% (50)
Cambridge	41% (353)	39% (118)	29% (38)
Physics	**Year 1**	**Year 2**	**Year 3**
Leeds	24% (84)	28% (79)	26% (72)
Cambridge	25% (362)	16% (146)	8% (107)

The reduction in the proportion of women taking these subjects at Cambridge over a three-year period is matched by an increase in other subjects, notably pathology, psychology and zoology.

The data suggest that there are large differences between universities in the number of women recruited into and retained by the undergraduate course, a difference that may be related to the amount of choice. The proportion of women in Cambridge choosing physics in their final year is particularly low.

3.2 Students' backgrounds

The perception of many commentators is that single sex schools provide a better environment for girls who wish to study science. Just over half the women in the survey (54%) attended mixed sex schools between the ages of 13 and 16, rising to 65% between 16 and 18. This compares to a national average of 87% of girls who attend mixed sex schools between 13 and 18.[4] Although the majority of the sample (65%) came from a managerial, executive or professional socioeconomic group, this is true generally for university students from all disciplines.[1]

3.3 Factors influencing choice of career

Most of the 47 women interviewed (70%) decided between the ages of 11 and 16 to go into science. The most commonly cited factors influencing them in their choice were enjoying science at school (42%), a talent for the subject (30%), and encouragement from parents (23%) or teachers (21%). Five interviewees (11%) admitted that science was only their second choice. Only one had a specific vocation to do research.

When asked about factors or incidents since then that had either confirmed their decision to study science or discouraged them, the women found it easier to identify negative influences. A stimulating or challenging first degree course was mentioned by six women as confirming their choice of science, but for five the most positive factor was that nothing had turned them off. Laboratory work, the mainstay of scientific research, was cited as a positive factor by only two interviewees.

Discouraging factors, however, were many and varied. Fifteen women cited a 'non-female culture' in academic science, ten were put off by uncertainties in the job market and nine mentioned irrelevant, badly taught undergraduate courses that did not 'relate to the real world'. Seven women were put off by working in isolation (in labs especially) and long hours that left no time for other interests. Six women anticipated difficulties combining a science career with having a family. A total of 16 other factors were mentioned as discouraging the women from a science career, including low salaries, an expectation within the work environment that women should 'behave like men' and the content of undergraduate courses. Full details may be found in appendix 3.1.

3.4 Career aspirations

The women were asked about their career aspirations. Despite reservations about a research career, 75% of the female questionnaire respondents thought that they were likely to make their career in science, as did 76% of the men. In answer to a separate question, 60% of the women expected to be in a career firmly based in science in ten years time and 22% expected to be in a related career (e.g. teaching science at school level). But only just over half of the women (57%) agreed or tended to agree that they saw their future selves as 'first and foremost a scientist', compared to 76% of the men. Of the 47 women interviewed, 27 (57%) planned to continue in science in some guise, with the remainder either unsure, planning a different career or disillusioned.

More women than men agreed or tended to agree that their future work should have 'clear practical application' (60% compared to 39% of the men). There was little difference between the men and the women in their attitudes to long-term projects (35% of both groups agreed that they liked being involved in long-term projects).

Undergraduates were asked about their plans after graduation. The majority of women wanted to work in areas that involved contact with people; 69% agreed or tended to agree with this, compared to 53% of the men. 72% of the women agreed that a science degree provided a training for life and not just for a career in science, compared to 55% of the men.

3.5 Attitudes to research

Asked about their attitudes to research, respondents' answers revealed some important differences between men and women. Women, and biochemistry students in particular, were more likely than men to believe that scientists worked long hours; 63% of the women (but only 37% of the men) agreed with this. Men were more likely than women to be happy undertaking defence-sponsored work, with 40% agreeing that they would take a 'good post...doing MOD sponsored work'. Only 7% of the women agreed with this. Women were less likely than men to want to work in scientific research which involved animal experimentation; 56% of women (but only 26% of men) stated that they would rather not undertake such research. Both men and women agreed with the observation that research seemed to be a male-dominated area.

Most of the women (79%) agreed or tended to agree that the word 'research' is associated with exciting new ideas, as did 73% of the men. Among undergraduates, 59% of the women (and 69% of the men) agreed or tended to agree that doing a PhD would be worth the time invested in terms of a better salary and career.

3.6 The academic/research environment

The absence of role models for women was cited by several of the organizations contacted (appendix 1) as a possible difficulty for women wanting to pursue research careers. However, the results show a degree of ambiguity on this topic among the women surveyed. The majority of women in the questionnaire survey (66%) either agreed or tended to agree that they did not need role models to keep them in a science career. Nevertheless, 87% of them agreed that there were few women on the staff and 92% agreed (or tended to agree) that scientific research was a male-dominated area.

Men, on the other hand, were more likely to see positive role models on the staff; 19% agreed that there were people of their own sex on the staff whose careers they would like to emulate whilst 10% disagreed. For the women, the figures were 6% and 34%, respectively. Most of the women in the survey (66%) disagreed or tended to disagree with the statement that women had to choose between a career and a family.

Despite the women's confidence that they did not need role models to succeed, the male culture of science departments and the difficulties of being taken seriously in a male-dominated profession were cited by almost half of those interviewed (42%) as factors putting them off research careers.

3.7 Sexism/harassment

Interviewees were asked if they had experienced sexual harassment from staff or students. For over half (55%), this was not an issue. A minority reported different experiences. Two students reported physical harassment and four said that they had experienced sexist attitudes among staff.

3.8 Ideas for funding bodies

With one aim of the study being the recommendation of possible courses of action by research funding bodies, the interviewees were asked for suggestions. The most common was the introduction of career breaks and part-time working (or job sharing) and some way of helping women to keep in touch with scientific developments whilst on a break. Other ideas included the provision of staff development for women scientists, assistance with childcare costs and sponsorship of competitive posts for 'scientists following partners' targeted at women (or men) who are forced to move because of their partner's work. However, almost a quarter of the women interviewed gave no answer to this question.

The study aimed to uncover factors that may be dissuading women from taking up careers in research. Given the small scale of the study, the results should be treated with caution. Nevertheless, some broad conclusions may be drawn.

There was no evidence that at this stage, any single factor was deterring the women in the study from careers in scientific research. The majority had attended single sex schools (although a sizeable minority had not). Almost three-quarters had decided to study science between the ages of 11 and 16. This is not surprising given the structure of the UK education system, which encourages early specialization. Having reached undergraduate and postgraduate level, most of the women in the study expected to make their careers in science. From the interview data, a stimulating first degree course was identified as an important factor in encouraging women to continue in research. But there were some indications of dissatisfaction with aspects of the undergraduate course, described by one student as "designed by men to suit male undergraduates as they will have been themselves".

Nevertheless, several factors taken together made research relatively unattractive as a future career. Chief among these was the ethos surrounding academic research, where poor conditions of employment and an uncertain job market are accepted as the norm. Because no interviews were conducted with men, it is not possible to say if these factors are any less off-putting for them.

However, data from the questionnaire survey (appendix 3.2), which included men, did point to some differences in attitudes to research between men and women. Women were more likely to think that scientists worked long hours. They were more likely to agree that they would not want to work in scientific research which involved animal experimentation. Women were also less likely than men to want to take up defence-sponsored work.

The idea that women may be more inclined towards applied research (as opposed to fundamental research) was also given some support by the fact that 60% of the questionnaire respondents agreed or tended to agree that their future employment must have clear practical applications. The equivalent figure for the men was 39%.

From the questionnaire survey, women were also more inclined than men to see a science degree as a general training for life (72% compared to 55%). This was reinforced by one physics undergraduate who commented "I think that not enough time is spent on teaching students in physics about skills relevant to careers not relating to research e.g. scientific publishing, management, information studies etc. The careers talk given

here only concentrated on PhDs and teaching, but the skills of a scientist can be applied to many other careers".

Contrary to expectation, most women did not believe that they needed role models to succeed in science research. Nor was any evidence found of a lack of confidence among the women in the study or of any active discouragement from teachers or tutors. But many of the women acknowledged the difficulty of being taken seriously in a male-dominated profession. The imbalance in numbers at senior levels effectively cast them in the role of outsiders, especially in physics. In this context, it is possible that the traditional way forward for aspiring scientists, namely mentoring by senior scientists, does not favour women. But further research would be needed to explore the influence of this on women's careers.

Finally, the nomadic lifestyle associated with establishing a career in research was not seen as compatible with family life. Although the women interviewed in this study did not accept that choosing between a career in science and having a family was inevitable, there was concern expressed about the difficulties of combining the two.

The reasons for the shortage of women in science are complex and these data do not point to easy solutions. The problem is partly related to the common difficulties faced by women in traditionally male-dominated subjects, but the structure of academic careers and the way in which scientific research is conducted also play a part. Nevertheless, some of the problems highlighted could be addressed by funding bodies and universities and a number of suggestions to that effect were made.

A number of suggestions and recommendations arose during the study for measures that could be taken by funding bodies and universities to improve the recruitment and retention of women in scientific research careers. Some of the problems highlighted in the study are not easily resolved, e.g. questions surrounding defence funding or the use of animals in research. But other concerns could be addressed. Some steps could be taken to begin to change the academic work environment. Similarly, universities may benefit from a review of their approaches to undergraduate teaching and careers advice.

5.1 Funding bodies

- Science research funding bodies should take practical steps to facilitate part-time working, career breaks and job sharing for scientists, with the aim of making such arrangements a normal part of working life.
- Grants should be extended as a matter of routine where researchers take maternity leave.
- Provision of expenses towards childcare costs should form part of a grant application or other forms of childcare support should be considered (e.g. crêche facilities).
- Special help for individuals returning to science should be promoted (along the lines of the Wellcome Trust Re-entry Fellowships, which support experienced postdoctoral returners for one year's research retraining plus three years' research).
- Provision should be made for professional staff development beyond technical expertise (e.g. management skills).
- Consideration should be given to ways of providing support for scientists while they are taking career breaks. This could include bursaries to cover the cost of journals, meetings and conferences.

5.2 Universities

- Universities should monitor the gender balance of courses throughout undergraduate and postgraduate courses, including admissions, course option selections and dropout statistics.
- Universities should review their approaches to undergraduate science teaching with equal opportunities considerations in mind, concentrating in particular on course design and content, and teaching methods.
- Universities should review their approach to careers advice, with particular emphasis on the broader options open to science graduates.

5.3 Further work

The data suggest that at undergraduate and postgraduate level women are not being turned off research in large numbers. Nevertheless, even at this stage in their careers, there are differences in the attitudes and concerns of men and women.

As a pilot study, the findings are based on a small sample. A larger sample combined with specific case studies would enable apparent differences in attitude to be explored in more depth. Further studies might also extend to the postdoctoral level where the dropout rate for women scientists is higher.

1 University Statistics 1992 – 93. Volume 1. Students and Staff. Universities Statistical Record.

2 The Rising Tide. A report on Women in Science, Engineering and Technology 1994. HMSO, London.

3 Thomas, K (1990) *Gender and Subject in Higher Education.* Open University Press.

4 Department of Education. Private communication

Edinburgh Women's Science Forum

Gender and Science and Technology (GASAT)

Women Chemists Committee

Women in Engineering Society

Women's Engineering Society

Women in Physics' Committee

Women in Technology and Science

Women in Technology in the EC (WITEC)

Women into Science and Engineering (WISE)

Women Scientists and Engineers in Scotland

Gender differences and science careers: interview protocol

1 Background, reasons for the study
Front of questionnaire
Interview/questionnaire/interview: 20–30 min

2 Please think back to when you first decided to go into science.
When was this?
What were the key factor(s) that led to this?
Since then, can you recall any incidents or factors which have tended to confirm this choice or to put you off? [prompt: through school, exams, family, time at university as an undergraduate or postgraduate]

3 Now please would you complete the questionnaire. If when you're going through it, you're reminded of other factors which have influenced your thinking about a science career, make a mark in the margin.

4 Has the questionnaire made you think of any more influences on your thinking about a science career? [If so, identify and discuss]

5 Briefly ask opinion on: importance of numbers of women in a department versus style of participation

6 Any experience of sexual harassment from staff, students?

7 What constitutes discouragement from a science career?

8 What constitutes encouragement towards a science career?

9 What could funding bodies do to help?

10 Respondent's background. How did she choose this particular course?

11 Current career plans

Appendix 3.1 Interview results

This section gives the raw data from the interviews with 47 women, being the number of respondents stating an opinion, reporting a fact, or making a suggestion. The first figure is the total number (out of 47); the second and third figures relate to the number from Cambridge and Leeds, respectively.

1 "Please think back to when you first decided to go into science. When was this?"

19	6	13	11–14 years of age
14	5	9	15–16 years of age
5	0	5	*c.* 18 years of age
5	3	2	Always wanted to
3	2	1	Primary school years
1	0	1	(Missing)

2 "What were the key factor(s) that led to this?"

20	4	16	Enjoyed subject, interested in it
14	7	7	Good at science/physics/etc.
11	5	6	Parental influence and/or role modelling
10	3	7	Teacher encouragement
5	0	5	Missed grades for preferred subject (e.g. medicine)
4	4	0	At girls school where science was being actively promoted
3	0	3	Drifted into it
2	0	2	Disliked aspects of alternatives (e.g. essay writing)
1	1	0	'Road to Damascus' conversion experience
1	0	1	Careers teacher encouragement
1	0	1	Forced into it by unavailability of preferred sixth-form course
1	0	1	Specific practical work experience at school
1	1	0	Specific research vocation (e.g. cancer research)
1	1	0	Tossed up between equally preferred/qualified for options
1	1	0	Saw original preferred option (e.g. medicine) as unattractive career
1	1	0	Gaining fall-back qualification before training for preferred career

3 "Since then, can you recall any incidents or factors which have tended to confirm this choice ...?"

6	2	4	Stimulating/challenging first degree
5	2	3	Nothing turned me off!
2	1	1	Final year undergraduate project; practical/laboratory work generally
2	0	2	A supportive undergraduate tutor
2	0	2	Excited by current work
1	1	0	Married another scientist
1	1	0	Being at an all-women's college
1	0	1	"Wellcome Foundation Studentship"

4 " ... or to put you off?"

15	6	9	Non-female culture, no appropriate role models, low proportion of women on course
10	2	8	Difficulties in getting jobs, especially senior jobs; job market uncertainties generally
9	3	6	Undergraduate course, general comments: e.g. irrelevant, overall poor teaching, doesn't relate to real world
7	1	6	Working in isolation (in labs especially) – want to be with people
7	6	1	Long working day in science career – no time for other interests
6	3	3	Problems envisaged in combining science career with family
6	2	4	Salaries in science seen as low
6	3	3	Undergraduate course specifics: e.g. experiments are boring/pointless/don't work, too few options too late
5	2	3	Sexism in work environment, women not taken seriously, made to feel cissies if don't behave like men
4	1	3	Academic life/career seen as unattractive, difficult to manage/balance
4	1	3	Public debate is intimidating for women, especially in an aggressive departmental atmosphere
4	2	2	Generally losing excitement over subject
3	3	0	Intimidating small group teaching, teachers clearly untrained in group methods
3	1	2	Sexist or humiliating teacher
3	0	3	Experience of setbacks and difficulties with scientific work
2	0	2	Safety aspects of scientific research: e.g. use of carcinogenic and radioactive materials
2	0	2	Bad/nonexistent careers advice
2	0	2	Attracted elsewhere rather than put off science
2	0	2	Expectation of difficulties in getting career break/part-time work/job share
1	1	0	Department seen as uninterested in students, students 'sacrificed to research'
1	0	1	Embarrassed to ask for help in moving heavy research equipment
1	0	1	Difficulty in managing her relationship with working class parental family

5 "Have you any opinion about the importance of the numbers of women staff in a science department versus their style of participation?"

19	11	8	No comment; issue not regarded as important
11	4	7	Need more women (e.g. one/lab; "at least one woman lecturer")
10	0	10	Need more women with different style from men (good scientists with personal integrity)
5	1	4	Not a problem (more women already entering science)
2	0	2	Number/style unimportant

6 "Have you any experience of sexual harassment from staff or students?"

26	5	21	Not an issue for respondent
8	3	5	None; but if found, it's stamped on
4	2	2	Sexist attitudes experienced from staff
2	1	1	Harassment experienced from staff: physical touch
2	1	1	Harassment involving language, whistles in department (but not all units)
2	2	0	No personal experience but seen it happen to others
1	1	0	Little sexism here: more talk about it
1	1	0	Sexist attitudes widespread amongst students
1	0	1	Harassment is subtle: language and behaviour are OK!

7 "For you, what constitutes discouragement from a science career?"

NB: Few responses were given to this question and the one which follows; the interviewer was referred back to responses to items 3 and 4, respectively

4	1	3	Comments made: patronising attitudes from men; lack of women around; lack of travel, excitement and opportunities for advancement; "old-fashioned teaching (e.g. 600 to a lecture)"

8 "And what constitutes encouragement towards a science career?"

3	2	1	Comments made: finding the right project; getting some results; good teaching

9 "What could funding bodies do to help?"

14	2	12	Help women on career breaks: keep in touch, conferences/courses, provide them with journals
11	6	5	Don't know/no answer
8	0	8	Provide staff development for women scientists: e.g. management, teaching, assertiveness
5	0	5	Go (women) to schools and educate them not to gender-stereotype
5	1	4	Sponsor (competitive) posts for "scientists following partners" (men/women)
4	2	2	Fund fora at schools, universities, to demonstrate utility, outcomes, of scientific research
3	2	1	Encourage job-sharing and part-time jobs within grants they award
3	0	3	Finance childcare for returners/low-paid researchers
2	2	0	Fund national meetings for women scientists to help networking
2	1	1	Work to make career breaks more possible, normal and expected
2	0	2	Encourage provision of broader career advice (i.e. including about industry)
1	1	0	Look at how their grant-giving systems could be made fairer to women (e.g. "use interviews more")
1	0	1	Provide hotline service for women about employment issues
1	1	0	Provide more accessible information on grants, jobs, available
1	0	1	Provide schools with exciting project material so science is seen as relevant
1	0	1	Fund first degree would-be scientists whose gender-stereotyping parents won't support them
1	1	0	Help women on career breaks: creches to permit part-time teaching etc
1	1	0	Examine science environments and their support systems (or lack)

10 "What, broadly, are your current career plans?"

10	1	9	Continue in science/subject: probably outside academia, industry
7	2	5	Continue in science/subject: don't know where
6	3	3	Continue in science/subject: for present, undertake more training
6	3	3	Unsure
4	1	3	Related career planned (e.g. pharmaceutical firm management)
4	2	2	Other career planned
4	1	3	Continue in science/subject: probably academic environment
3	2	1	Probably continue in subject: currently disillusioned
1	1	0	Unsure: stimulated by science but uncomfortable
1	0	1	Children now then think later
1	0	1	Voluntary work planned, then ?

Appendix 3.2.1 Women's responses to the questionnaire (*n* = 68)

	Agree	Tend to agree	?	Tend to disagree	Disagree
The working hours that seem to be put in by scientists are high	43	19	3	2	1
Scientific research seems a male-dominated area	35	24	4	4	1
In this department/subject, male and female students are treated equally	33	19	8	7	1
In this university generally, male and female students are treated equally	28	26	8	5	1
I'm likely to make my career in science	25	26	9	5	3
This department seems to care for its students	26	28	7	6	1
For me, the word 'research' is associated with exciting new ideas	24	30	5	6	3
There is little sexist language used by teachers in this department/subject	22	19	11	8	8
I don't need 'role models' to keep me in a science career	28	17	7	15	1
I chose this subject to study on the basis of its intellectually challenging nature	29	24	4	9	2
I like to be involved with long-term projects	24	26	11	5	2
I have been in love with science since I was at school	21	28	4	10	5
If one wants to make a serious career in science, one needs a PhD	26	24	3	11	4
I see my future self as first and foremost a scientist	18	21	6	20	3
I would not want to work in scientific research which involved animal experimentation	38	5	7	9	9
I find the course/work here very exciting	11	33	10	10	4
Hearing about lecturers' research greatly stimulates me	11	26	18	11	2
The future work (employment) I will undertake must have clear practical application	16	25	7	14	6
There are good 'role models' of my own sex on the staff here	7	20	5	12	24
My academic work is the most important thing in my life, currently	12	18	5	23	10
If a good post came up doing MoD (= defence-sponsored) work, I'd be happy to apply	5	17	12	14	20
There are few members of my sex on the academic staff here	49	10	1	3	5

APPENDIX 3. QUESTIONNAIRE RESULTS

	Agree	Tend to agree	?	Tend to disagree	Disagree
Women applicants for jobs in science are often discriminated against	4	10	34	16	4
Sexist language doesn't worry me	8	14	7	15	24
I don't find that I can get very close to members of the staff in this department	6	19	6	26	11
I see people of my own sex here whose careers I would like to emulate	4	15	9	17	23
I don't get much encouragement towards a research career from my tutors	4	17	6	22	19
In a science career, it would be a fight for jobs against the opposite sex	10	20	11	23	4
Women's early job prospects in science are less good than men's	3	10	16	17	22
Scientists in this subject tend to be 'loners'	7	10	6	32	13
Most of my university friends are also taking the same subject(s)/course(s) as me	7	16	3	20	22
When I first came to university, I wasn't particularly planning a lifetime in science	12	13	2	19	22
I often find it difficult to speak and participate in small groups/supervisions	6	13	5	21	23
I find I'm being put off any idea I may have had of a science research career	8	9	8	16	27
Women have got to make a choice between a career and having a family	4	15	4	16	29
Science may well not be a particular feature of my career	7	8	5	25	23
Lecturers here can be quite hurtful in the criticisms they make of students	5	13	6	23	21
Much research in science amounts to a waste of resources which could be better spent	3	5	8	26	26
Some encounters with staff here have really discouraged me from a science career	3	10	6	22	27
Sometimes, I feel my questions (in classes, meetings) aren't taken seriously	3	5	6	24	30
Much sexist language is used by students in this department/subject	5	4	3	27	29
There is an abrasive and aggressive atmosphere in this department	3	5	8	21	31

APPENDIX 3. QUESTIONNAIRE RESULTS

		Agree	Tend to agree	?	Tend to disagree	Disagree
	I associate the word 'research' with long, boring descriptions of experiments	4	4	3	18	39
	Sometimes I'm overwhelmed by the number of students of the opposite sex on this course	2	7	2	30	27
	Careers in scientific research are probably not appropriate for women	0	2	2	17	47
For under-graduates only (n=39)	Doing a PhD will be worth the time invested in terms of better a career/salary	16	7	4	7	5
	The work I will do after I graduate must involve lots of contact with people	16	11	9	3	0
	Science at university is a general training for life, not just for a science career	9	19	3	6	2
	The course here is making me more interested in a research career	8	8	7	11	5
	I want to do work which is practical (rather than thinking/theory based) when I graduate	9	8	11	7	4
	I'm too unsure of what sort of a career I want to have, to decide to do a PhD	6	7	7	9	10
	Three or more years to do a PhD is too expensive a commitment to make now	8	11	3	9	8
	I find the prospect of a job more challenging than the prospect of PhD research	8	9	3	14	5
	This course is not addressing important general skills areas (e.g. communication skills)	5	8	4	16	6
	I can't bear the thought of taking three years to undertake a research project	7	9	1	10	12
	The atmosphere in this department is such that I wouldn't want to do a PhD in it	2	1	4	11	21
	I'm not as self-confident as I was when I arrived at university	6	1	1	12	19

Background information of the women (n = 68)

Please indicate where you most likely expect to be, career-wise, in ten years time (tick one):

In a career firmly based in science (e.g. research)	41
In a related career (e.g. teaching science at school level)	15
In a career to which scientific training will not be relevant	8
Probably not in a 'career' in the sense of being formally employed	0
(no answer)	4

Status *(Undergraduate, n = 39; postgraduate, n = 26)*

1st Year Undergraduate	1
2nd Year Undergraduate	12
3rd Year + Undergraduate	26
1st Year Postgraduate	11
2nd Year Postgraduate	9
3rd Year Postgraduate	4
4th Year Postgraduate	2
Postdoctorate	3

Type of school attended aged 13–16

(NB:This and the next item were not answered by all respondents with regard to private/state school)

single sex	30	private	9	more than one school	1
mixed sex	37	state	46		
no answer	1	no answer	13		

Type of school attended aged 16-18

single sex	22	private	8	more than one school	0
mixed sex	44	state	46		
no answer	2	no answer	14		

Brothers and sisters

None	7
Yes, older	23
Yes, younger	51

Close family relative who is a scientist

Yes	25
No	43

Parental family's socioeconomic group

Managerial, executive or professional	44
Other office work – 'white collar'	7
Skilled worker – 'blue collar'	13
Unskilled worker	3

Appendix 3.2.2 Men's responses to the questionnaire (*n* = 62; undergraduates)

	Agree	Tend to agree	?	Tend to disagree	Disagree
The working hours that seem to be put in by scientists are high.	23	22	7	7	3
Scientific research seems a male-dominated area	25	26	4	6	1
In this department/subject, male and female students are treated equally	24	26	7	3	2
In this university generally, male and female students are treated equally	23	26	6	6	1
I'm likely to make my career in science	25	22	8	7	0
This department seems to care for its students	16	26	14	3	3
For me, the word 'research' is associated with exciting new ideas	17	28	8	8	1
There is little sexist language used by teachers in this department/subject	35	16	7	0	4
I don't need 'role models' to keep me in a science career	24	24	3	8	3
I chose this subject to study on the basis of its intellectually challenging nature	20	22	5	8	7
I like to be involved with long-term projects	12	30	11	8	1
I have been in love with science since I was at school	24	22	8	4	4
If one wants to make a serious career in science, one needs a PhD	17	24	5	11	5
I see my future self as first and foremost a scientist	21	26	5	9	1
I would not want to work in scientific research which involved animal experimentation	16	15	5	10	16
I find the course/work here very exciting	4	28	16	9	5
Hearing about lecturers' research greatly stimulates me	6	27	13	10	6
The future work (employment) I will undertake must have clear practical application	12	12	16	16	6
There are good 'role models' of my own sex on the staff here	19	19	16	5	3
My academic work is the most important thing in my life, currently	11	21	8	10	12
If a good post came up doing MoD (= defence-sponsored) work, I'd be happy to apply	25	13	6	4	14
There are few members of my sex on the academic staff here	4	1	1	6	50

APPENDIX 3. QUESTIONNAIRE RESULTS

	Agree	Tend to agree	?	Tend to disagree	Disagree
Women applicants for jobs in science are often discriminated against	3	11	31	9	8
Sexist language doesn't worry me	16	11	11	16	8
I don't find that I can get very close to members of the staff in this department	6	16	12	21	7
I see people of my own sex here whose careers I would like to emulate	12	14	19	11	6
I don't get much encouragement towards a research career from my tutors	5	13	20	16	8
In a science career, it would be a fight for jobs against the opposite sex	3	2	12	25	20
Women's early job prospects in science are less good than men's	3	15	27	8	9
Scientists in this subject tend to be 'loners'	2	14	13	23	10
Most of my university friends are also taking the same subject(s)/course(s) as me	6	15	9	11	21
When I first came to university, I wasn't particularly planning a lifetime in science	5	12	3	21	21
I often find it difficult to speak and participate in small groups/supervisions	6	16	4	14	22
I find I'm being put off any idea I may have had of a science research career	2	10	14	21	15
Women have got to make a choice between a career and having a family	4	13	11	14	20
Science may well not be a particular feature of my career	3	12	9	19	19
Lecturers here can be quite hurtful in the criticisms they make of students	0	2	14	31	15
Much research in science amounts to a waste of resources which could be better spent	3	7	13	16	23
Some encounters with staff here have really discouraged me from a science career	0	7	9	25	21
Sometimes, I feel my questions (in classes, meetings) aren't taken seriously	4	4	13	18	23
Much sexist language is used by students in this department/subject	2	4	13	20	23
There is an abrasive and aggressive atmosphere in this department	3	4	7	18	30

APPENDIX 3. QUESTIONNAIRE RESULTS

		Agree	Tend to agree	?	Tend to disagree	Disagree
	I associate the word 'research' with long, boring descriptions of experiments	3	4	9	24	22
	Sometimes I'm overwhelmed by the number of students of the opposite sex on this course	1	0	3	9	49
	Careers in scientific research are probably not appropriate for women	1	1	4	13	43
For under-graduates only (n=62)	Doing a PhD will be worth the time invested in terms of a better career/salary	17	26	10	7	2
	The work I will do after I graduate must involve lots of contact with people	13	20	9	12	7
	Science at university is a general training for life, not just for a science career	15	19	8	14	5
	The course here is making me more interested in a research career	7	22	16	14	2
	I want to do work which is practical (rather than thinking/theory based) when I graduate	9	15	18	10	9
	I'm too unsure of what sort of a career I want to have, to decide to do a PhD	14	12	7	16	13
	Three or more years to do a PhD is too expensive a commitment to make now	12	9	9	15	17
	I find the prospect of a job more challenging than the prospect of PhD research	9	10	8	18	16
	This course is not addressing important general skills areas (e.g. communication skills)	7	16	4	2	13
	I can't bear the thought of taking three years to undertake a research project	8	11	9	14	19
	The atmosphere in this department is such that I wouldn't want to do a PhD in it	5	7	8	21	20
	I'm not as self-confident as I was when I arrived at university	2	10	4	12	33

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