House of Commons Science and Technology Select Committee's inquiry: Women in STEM Careers

Written evidence submitted by the Royal Society of Chemistry (RSC)

Summary

- The issues raised in this consultation relate particularly to gender, but most of the recommendations could also be translated to support diversity more widely.

- The consequences of not addressing the barriers to inclusion are numerous and include implications for economic growth.[1]

- The proportion of women in academic chemistry, and other science subjects, decreases significantly with increasing seniority; in chemistry women account for 24% of non-professorial academic staff and 8% of professors.

- The barriers created by unconscious bias should not be underestimated, nor should the accumulation of factors that individually may seem insignificant.

- The early career research phase generally coincides with a woman's childbearing years, which for some introduces conflicts between responsibilities.

- The Athena SWAN Charter has proved to be a valuable scheme for tackling many barriers in academia; sufficient funding for this must be guaranteed in the long-term so that it can be evolved to be fit for purpose in a changing landscape such that the full benefits can be realised.

- Comprehensive, comparable and sex-disaggregated data are needed for both academia and industry, separated out by each STEM discipline.

- Research councils and funding councils should work with universities to coordinate policies on parental leave.

- Consideration needs to be given to funding mechanisms to ensure there are no unintended consequences for gender bias.

- The REF (Research Excellence Framework) requirements and process should be reviewed against any unintended consequences that might disadvantage women.

About this response

1. This document represents the views of the Royal Society of Chemistry. With 48,000 members and a knowledge business that spans the globe, we are the UK's professional body for chemical scientists. We work to shape the future of the chemical sciences – for the benefit of science and humanity.

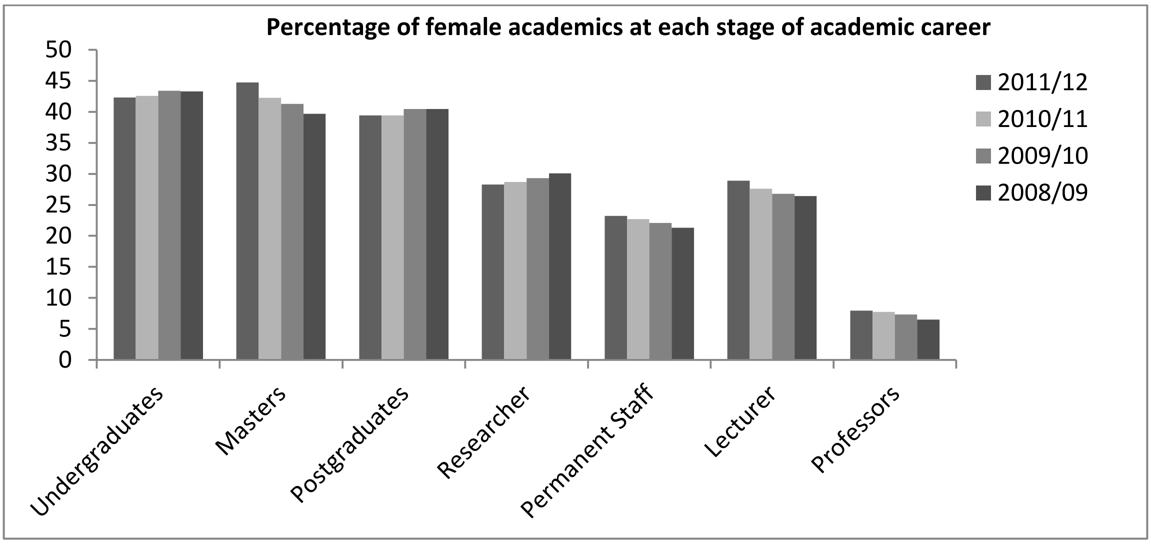
2. We have a duty under our Royal Charter to "serve the public interest" by acting in an independent advisory capacity. We are committed to promoting diversity and inclusion and understand that the success of our community depends on its ability to nurture the talent of the best people regardless of whom they are or their background. It is in this spirit that we make this submission.

3. The Royal Society of Chemistry supports members from diverse areas of the chemical sciences who are employed in professions across academia, industry, and beyond. This response is framed around academia but we acknowledge that the issues raised are widespread. For example, recent workforce data reveal the overall make-up of chemical scientists is 22,000 male versus 10,000 female.[2]

4. Our approach has been to base our response upon evidence, when available; however, the evidence required to make a truly informed response is lacking in large measure. We have therefore used anecdotal evidence to support some recommendations. Key RSC members have contributed, including those who are experts in diversity (including gender) issues, and those closely involved in the Athena SWAN application and assessment process.

Background data

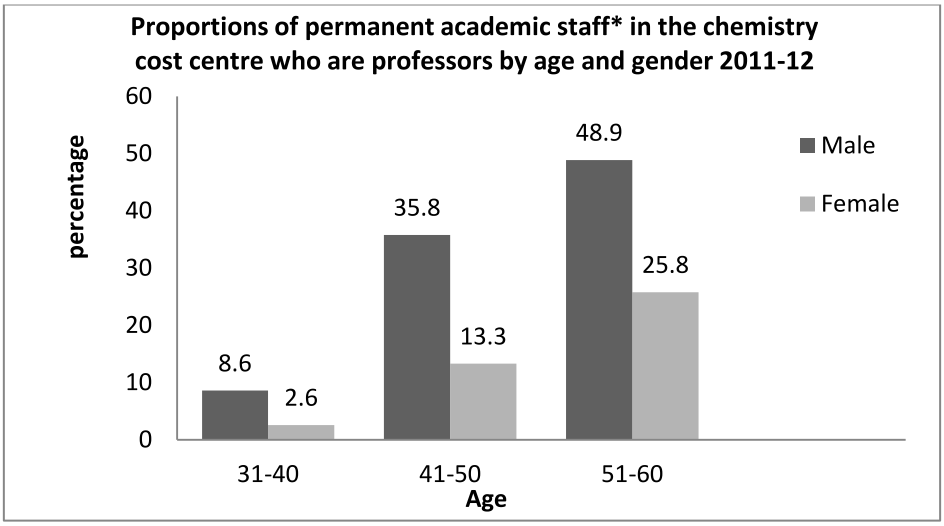
5. In the academic year 2011/2012 approximately 42% of the chemistry undergraduate population were women, a percentage that has remained relatively consistent since 2004/2005.[3] At masters level the proportion is similar at 44%, but this drops slightly to 39% at doctoral level. Thereafter, the proportion of women decreases significantly with increasing seniority, with women accounting for 24% of non-professorial academic staff and only 8% of professors.



Source: HESA[3] – Analysis by Royal Society of Chemistry

6. At undergraduate level, the gender profile for chemistry differs from that for physics, which has a lower representation of women (20%), and biology, which has a higher representation (58%). But in all three subject areas women do not progress at the same rate as their male colleagues, such that only 7% of physics professors are women and 20% of biosciences professors are women.[3] This suggests some common barriers to the retention and progression of women across these subjects.

7. The proportions of both male and female professorial staff in particular age bands of permanent academic staff – in chemistry and most other subjects – show that the low proportions of women professors cannot be explained by the makeup or history of the cohort.[3]



*Permanent academic staff are professors, senior lecturers/readers and lecturers
Source: HESA[3] – Analysis by Oxford Research and Policy

8. Academically, women achieve comparable results in chemistry at GCSE, A-level and undergraduate level.[3,4] Beyond this, there are numerous non-academic factors that contribute to the decline in the numbers of women in academia.

Why do numbers of women in STEM academic careers decline further up the career ladder?

At PhD level

9. Our own research found that almost half of the women beginning a chemistry PhD with the intention of following a career in research have changed their mind by the time they complete.[5] In contrast, men's intentions remain relatively unchanged over the same period.

10. Men and women in chemistry share some common concerns when considering a future career in academia, such as long hours, pay and the career structure. However, women speak of additional concerns that generally are less important to men. These include isolation and segregation, too much emphasis being placed on results and poor working conditions.[6]

11. Women report that the long hours and 'macho' or competitive culture make it more difficult for them to succeed. Some believe it is impossible to combine a fast-track career with having a family.[5]

12. The early career research phase generally coincides with a woman's childbearing years, which introduces a difficult dilemma between meeting perceived expectations for career advancement and focusing on personal relationships and family responsibilities.[5]

At postdoctoral research level

13. For postdoctoral researchers the picture is different between disciplines. Female chemists appear to develop more doubts than female physicists about a long-term academic career and are more likely to look towards industry. Across chemistry and physics departments, there is considerable variation in how postdocs feel they are viewed; female chemists being the least likely to feel-well regarded.[7]

14. There is often an absence of role models and mentors who can provide objective counsel and help young female scientists with career choices. In general, awareness of career options outside academia is low.

Career breaks

15. Women are more likely than men to take a career break for parental leave and are more likely to be working on a part-time basis.[8] Based on our *Trends in Remuneration Survey,* circulated to members in both academia and other sectors, 35% of women returning to work after parental leave responded that they felt their career prospects were worse since returning. Cultural pressures are such that even where parental leave is available to both men and women, women's careers continue to be most likely to be put on hold following childbirth.

16. We have found women are more likely than men to report experiencing difficulties after returning to work from general career breaks (including caring for children, sabbaticals, redundancies, travel and study breaks), with higher proportions reporting a lack of suitable roles, lack of confidence, difficulties in finding flexible/part-time working and suitable childcare.

Unconscious bias

17. Career breaks and part-time working does not wholly explain the gender differences in the academic pipeline;[9] unconscious bias plays a significant role. A recent study in the US showed that both male and female scientists demonstrate unconscious gender bias.[10] Based upon identical applications, female applicants were judged more harshly than male applicants and were offered significantly lower salaries. The barriers created by unconscious bias within a community and culture should not be underestimated. For example, in countries such as Sweden, where there has been decades of policymaking aimed at improving gender equality, women still have lower chances of becoming full professors than men.[9]

When women leave academia, what careers do they transition into? What are the consequences of scientifically trained women applying their skills in different employment sectors?

18. The evidence in this area is sparse and/or not readily available. Data show that women are more likely than men to take up positions outside of higher education, providing services such as training, education and analytical services; a trend supported by our own membership data.[5,8] The data available to us does not support that a larger proportion of women graduates transition into industrial research and development.[11]

19. Our membership data shows that in the chemical sciences men are more likely than women to take up managerial-level positions or positions of responsibility; figures supported by the Annual Survey of Hours and Earnings, 2012.[12] Furthermore, amongst our members men consistently earn more than women across all sectors at every age bracket over 30 years.[8] Relatively low pay is likely to be an issue when faced with high childcare costs. (Note that we do not have salary data on those women who choose to leave chemical science altogether.)

20. We should be concerned about the potential effect on the economy should women be working in roles beneath their level of capability, or moving out of the job market altogether. This represents a loss of knowledge, skills, investment in training and creativity.[1]

21. However, in cases where women are applying and transferring their skills at an appropriate and equitable level then the consequences can be very positive. The skills gained as part of a scientific education are valuable and applicable to many employment sectors outside science, and trained scientists can bring important expertise to other professions.

What should universities and the higher education sector do to retain women graduates and PhD students in academic careers? Are there examples of good practice?

22. Issues that universities must address include:
    - Bad work-life balance and the long hours culture.
    - Short-term contracts and the need to continuously undertake a competitive application process.
    - Focus on publication success, and consequences of a career break to this.
    - Lack of opportunity for networking, mentoring and skills development.
    - Uncertainty in career options and the assessment criteria for promotion.

    These issues affect men and women but in general the consequences for women's careers and career choices tend to be more pronounced.

23. Having support and buy-in from heads of school and other senior members of staff is a key factor for success.[13]

24. Research indicates different behaviours between genders: for instance, generally, women write more comprehensive and concise journal papers than men, resulting in fewer publications but ones that are more widely cited.[14] Recruiters should be aware of differences in order to remove unconscious bias.

25. There are differences in the way men and women respond to feedback.[15] Men's self-esteem is often relatively unaffected by the nature of the feedback, whereas women's self-esteem is often improved after positive feedback but drops substantially after negative feedback. Management training in how to give constructive feedback should be made compulsory for anyone in a supervisory role.

26. Universities should facilitate networks, mentoring and other support systems to help women and other scientists find and maintain a healthy and productive work-life balance, and to provide a mechanism to talk through career options and solutions.

27. Universities and research funders together should develop better, more effective ways of dealing with parental leave.

28. Universities should offer more flexibility with contracts to help those with (child) caring responsibilities. Term-time working should be given due consideration.

29. Universities should ensure they are inclusive when considering the timing of staff meetings and seminars.

30. Feedback from postdoctoral researchers suggests that policies for training and development are inconsistently applied and there is uncertainty as to whether they are entitled to regular appraisals.[7] Universities should support and share best practice for skills training (both technical and soft/transferrable skills) and include career development as part of appraisal discussions, for both permanent and contractual staff.

Good practice

31. Vitae[16] are taking a lead in career management for researchers through their researcher development framework. The University of Warwick is an example whereby professional development is championed through their transferrable skills course for postgraduate and postdoctoral researchers.

32. The Athena SWAN Charter is a valuable scheme to tackle many gender issues; raising the importance of such matters and encouraging collection and interpretation of the data needed to change policies and practices. Action plans produced for Athena SWAN applications provide a mechanism to change cultures. Many departments/universities advertise their award status in order to attract and retain the best people.

33. Chemistry departments at York, Edinburgh (both Athena SWAN Gold Award holders), and Imperial and Warwick, are amongst those leading the way in terms of good practice in the UK. The University of Michigan, which receives funding *via* the NSF Advance programme,[17] is also a good example.

What role should the Government have in encouraging the retention of women in academic STEM careers?

34. There is a need for comprehensive, comparable, disaggregated data for gender and scientific discipline, particularly industry. Currently, there is insufficient reliable evidence to build effective policies, or to help policymakers identify areas to target for intervention. Without good evidence, gender policies will remain low priority.

35. Data collected must be analysed by people with the appropriate knowledge and expertise.

36. The UK does not contribute to the database compiled by the UNESCO Institute for Statistics (UIS), the primary source of cross-nationally comparable statistics on science and technology, education, culture, and communication. The reason is that the data collected in the UK is incomparable with that gathered by UIS and other global bodies, being based upon full-time equivalents (FTEs) rather than headcounts (HCs). This should be remedied.

37. Government policies that mandate childcare, equal pay and gender mainstreaming have been shown to improve the representation of women. However, if policies are not funded sufficiently, women remain poorly represented.[18] The Government should work to ensure that couples have genuine choice regarding which partner takes extended leave following childbirth so that the burden does not predominately fall on women, whose individual careers often suffer as a result.

38. The Athena SWAN Charter is a world-leading scheme. As yet its impact is unmeasured, but changes in the academic pipeline will take time. Nevertheless, anecdotal evidence from those involved in the scheme suggests it is effective. The scheme should therefore be continued.
    - Funding for the Athena SWAN Charter must be guaranteed at the right level in the long-term so that the full benefits can be realised and demonstrated.
    - Trend data from institutions should be combined, analysed and compared nationally through appropriate qualitative research.
    - Additional funding is needed to cover the increasing numbers of Athena SWAN submissions following recent statements from research funders regarding the need for applicants to evidence work on gender equality.
    - Additional funding should be provided to develop an effective future strategy for Athena SWAN.

39. Unconscious bias is a key barrier to gender equality but it is not well understood. Government should fund research into unconscious bias to give universities methods to tackle it that are based upon evidence and a better understanding. Such methods should form part of Athena SWAN action plans.

40. The Research Excellence Framework (REF) is the new system for assessing the quality of research in UK higher education institutions (and informing funding decisions). The Department for Business, Innovation and Skills (BIS), through HEFCE, controls the methodology of REF and so is responsible for its effects.

    We suggest HEFCE reviews the REF process to check for any potential, unintended effects on the gender balance in STEM disciplines. Procedures that may have unintended consequences are those that do not recognise collaborative ways of working, which women tend to prefer, and procedures that lead to (or reflect) particular individuals having a celebrity-like status within their community – the majority whom are currently men due to the existing demographics – all of which may further exacerbate unconscious bias issues.

    Current REF processes which should be given consideration include that:
    - Universities are allowed to choose the researchers they submit for REF, which emphasises the individual over the collective. The size of the unit of assessment should become the average size declared in the HESA data during the assessment period, so all staff are automatically included.
    - Universities are allowed to choose which outputs are assessed, which may exacerbate the above and create negative drivers. The REF process should judge all outputs and inputs during the whole assessment period, rather than linking to a single point in time.
    - Universities are assessed by who they employ on a 'census date', such that outputs are linked to (and could be 'transferred' with) an individual. Outputs/inputs should be based on the author's institution at the time of publication or grant announcement.

41. Research Councils UK (RCUK) and funding bodies have a role in shaping the culture of academia. Consideration should be given to whether large funding grants that are linked to particular individuals reduce the funding available for returners to work, collaborative working and longer-term projects.

42. In January 2013, RCUK's *Statement of Expectations for Equality and Diversity* was a positive move. Research Councils should also work with universities to coordinate policies on maternity/adoption leave at all academic levels.

43. The UK Resource Centre (UKRC) for Women in Science, Engineering and Technology (now incorporated into WISE) provided a single, immediately identifiable source of information, support and advice for women in STEM, and their employers. Should the Government be unable to demonstrate that the current mainstreaming of diversity through alternative BIS funded programmes matches the success delivered by the UKRC - for example reaching directly over 7,000 women and 300 organisations (employing over a million people) in all sectors of STEM - funding should be provided for a flagship organisation to champion the interests of women in STEM across all disciplines and employment sectors, akin to the UKRC or the Association for Women in Science (AWIS) in the US.

44. The Government should compare the level of importance and funding it gives to gender diversity against other world-leaders in STEM research, such as the US, Germany and Japan. Lessons could be learned from other countries.[17]

45. Given the different data profiles of the various STEM subjects, there is a role for the different learned societies in identifying specific issues. Adequate funding needs to be made available for this work to be done.

[1] *Maximising women's contribution to future economic growth*; Women's Business Council (supported by Government Equalities Office); June 2013

[2] Office for National Statistics Labour Force Survey 14 August 2013

[3] Higher Education Statistics Agency (HESA) Student Record 2004/05 - 2011/12 & HESA Staff Record 2004/05 – 2011/12).

[4] Joint Council for Qualifications – GCSE and Entry Level Certificate Results Summer 2012 (http://www.jcq.org.uk/examination-results/gcses/gcse; JCQ – A, AS and AEA Results Summer 2013 (http://www.jcq.org.uk/examination-results/a-levels/a-as-and-aea-results-summer-2013); HESA Student Record 2004/05 - 2011/12

[5] *Change of Heart: Career Intentions and the Chemistry PhD*; a Royal Society of Chemistry report; 2008

[6] Study of the factors affecting career choices; a Royal Society of Chemistry report; 2000.

[7] *Mapping the Future: Physics and Chemistry Postdoctoral Researchers' Experiences and Career Intentions*, 2011, A joint report by the Royal Society of Chemistry and Institute of Physics

[8] Royal Society of *Chemistry Trends in Remuneration* survey of members; 2010 and 2013

[9] R. Danell & M. Hjerm; *Scientometrics*; 2013; **94** (3); 999

[10] C. A. Moss-Racusin *et al.*, Proceedings of the National Academy of Sciences of the United States, **109** (41), 16395, 2012

[11] Data on applications to departments within Proctor & Gamble that typically require STEM qualifications between July 2012 to July 2013

[12] Annual Survey of Hours and Earnings 2012; Office for National Statistics

[13] Feedback from our members; Athena SWAN: charter for women in science, measuring success; 2011

[14] UNESCO; Science, Technology and gender: An International Report and Executive Summary; 2007

[15] M. Johnson & V. Helgeson; *Sex differences in response to evaluative feedback: a field study*; Wiley; 2002

[16] Vitae is a network-based organisation working in partnership with higher education institutions, research organisations, funders, and national organisations to meet society's need for high-level skills and innovation and produce world-class researchers.

[17] Since 2001, the National Science Foundation (NSF) has invested over $130M to support ADVANCE projects at more than one-hundred institutions of higher education and STEM-related not-for-profit organizations in forty-one states, the District of Columbia, and Puerto Rico.

[18] S. Huyer & N. Hafkin; *The right policies can fill the gender gap in science*; an assessment by Women in Global Science and Technology (WISAT) and the Organisation for Women in Science for the Developing World (OWSD); 2012