House of Commons Select Committee – Enquiry into Women in STEM careers

Written response from the University of Oxford

1. This submission was prepared by Trudy Coe, Head of Equality and Diversity at the University of Oxford, and submitted on behalf of the University by Dr Sally Mapstone, Pro Vice-Chancellor (Education). We are not aware of any conflict of interests.

2. The submission is informed by the surveys we have conducted across our science and medical science departments, consultation with individual women scientists and evidence from external studies. We focus in particular on the experiences of women in a research-intensive, international university but many of the barriers we cite are relevant to all women in academic STEM.

3. We define STEM as including science, technology, engineering and mathematics. Many of the issues we discuss also affect women in medicine, but there are differences in career paths and opportunities, which require separate consideration.

4. We also note that STEM subjects are not equivalent and that, while there are common factors, the issues surrounding female career progression differ as between disciplines and departments, as between institutions and as between countries. In particular, in some science disciplines in the UK the problem is primarily one of entry rather than of attrition. For example, fewer than one in five A level Physics students is female; and, in 49% of maintained co-ed schools, no girls progress to A level Physics. This leads not only to a gender imbalance in Physics departments, but also to the under-recruitment of women in those STEM subjects for which Physics is a facilitating A level (e.g. Engineering, Materials).[1]

5. Progressing gender equality is one of the University's key strategic priorities, evidenced in our Strategic Plan 2013-18, our commitment to Athena SWAN and the launch in July 2013 of a £1million Vice Chancellor's Fund for Diversity, initially targeted at addressing the under-representation of female academics and researchers.

6. Research is core to our mission, and addressing the gender gap in STEM is central to that. We employ 1,627 academics and 3,650 researchers: 85% of research staff are in science and medical sciences.

Question 1: Why do numbers of women in STEM academic careers decline further up the career ladder?

[1] http://www.iop.org/education/teacher/support/girls_physics/file_58196.pdf

7. While the under-representation of women is not unique to STEM, the nature and organisation of academic science and technology creates additional obstacles to the participation and progression of women, which are not found in other fields. The various obstacles are both cumulative and inter-active. For example, the long-hours culture and requirement to be internationally mobile makes it difficult to combine work and family which reduces the number of senior female scientists – which in turn impacts on departmental culture and the availability of role models for the next generation. The problem is complex and not capable of easy resolution.

8. In discussing the barriers - and potential solutions - we distinguish between the following:

    a) Issues particular to academia (e.g. the prevalence of short-term funding)

    b) Issues particular to STEM, which we further categorise into:

        a. The nature and organisation of scientific work
        b. The gendered nature of science
        c. Environmental issues (e.g. health and safety)
        d. Low numbers of women

    c) The gendered nature of work and family care in the UK

    Cumulatively, these issues impact unfavourably on the culture of STEM departments and institutions, which are perceived by women to be less supportive of their careers than those of men.

a) Issues particular to academia

9. The Royal Society of Edinburgh report[2] found that: 'the insecurity of being on a fixed term contract [FTC] is one of the main barriers to successful academic careers faced by women researchers'; while data published by the Equality Challenge Unit[3] shows that female UK academics are more likely than men to be employed on such contracts.

10. The lack of security in relation to FTCs particularly deters women from staying in science – in part because they cannot create a sustainable career while planning for or having a family. The problem is particularly acute in research-intensive universities, where career advancement is dependent on experience gained internationally through a number of short FTCs in different institutions. Leemann's research on the academic careers of PhD graduates in Switzerland, for example, reveals how gender, children, dual-careers, social class and academic integration, produce inequalities in transnational academic mobility that in turn affect individuals'

[2] Women in science, technology, engineering and mathematics: a strategy for Scotland, April 2012
[3] Equality in higher education: statistical report 2012. Part 1: Staff

accumulation of international cultural and social capital[4].

11. The lack of funding security is compounded by pressure to advance early in a career on a competitive basis, judged in research-intensive universities by applications for grant funding, maintaining a constant and high volume of publications and publishing scientific breakthroughs before colleagues. Women appear to find this early career pressure more of a deterrent to staying in academia than do men and a number of studies show that men perform better than women in highly competitive environments.[5]

12. The intense nature of the competition means that early career research roles are seen exclusively as full time positions, requiring long hours, deterring at an early stage women who have children. Part-time work in academia is seen as low status, whereas many competing employers, including the NHS, provide high quality, well paid part-time roles.

13. The problem is compounded by the contract status of women taking maternity leave: depending on the timing of the birth of a child they may be not be eligible for full maternity pay, and have little opportunity between contracts to apply for other roles.

14. Grant-awarding processes themselves may not be free from bias, as evidenced by the report of the League of European Research Universities (LERU)[6]. Even if the allocation process is bias-free, evidence shows that women are less likely to apply for funding; apply for smaller amounts of funding for a shorter duration; and wait longer after rejection before applying again[7]. As a result, they progress more slowly up the career hierarchy, reducing the number of women in senior positions.

15. Early differences in grant funding, combined with the gendered nature of science, lead to long-term gender differences in access to resources. These were first evidenced by a group of women faculty from MIT who demonstrated that, in every aspect of academic life, including salary and size of office, women were allocated fewer resources than men.[8]

16. Finally, there is an encouragement of specialisation in academia which is the reverse of career formation in some professions (e.g. the Civil Service); and some indication that women, more than men, find this degree of specialisation unpalatable – perhaps

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[4] Leemann, R.J. (2010) 'Gender inequalities in transnational academic mobility and the ideal type of academic entrepreneur' Discourse: Studies in the Cultural Politics of Education 31(5): 609-625.)

[5] http://www.ieb.ub.edu/aplicacio/fitxers/SM10Morin.pdf

[6] Women, research and Universities: Excellence without gender bias. July 2012. http://www.ub.edu/farmacia/recerca/LERU/LERU_Paper_Women_universities_and_research.pdf

[7] Key factors shaping funding application behaviour among women and men in British higher education institutions, summary report prepared by Margaret Blake, Ivana La Valle, National Centre for Social Research, Wellcome Trust 2001http://www.wellcome.ac.uk/stellent/groups/corporatesite/@policy_communications/documents/web_document/wtd003210.pdf

[8] A Study on the Status of Women Faculty in Science at MIT, 1999.

because of concerns about how long they will be able to sustain an academic career. As researchers progress, their career path becomes increasingly narrow until it reaches a point where it is not possible to do anything but leave if the individual cannot make the transition to the next level.

17. At Oxford, our main point of career attrition is between post-doctoral researcher and University Lecturer (our main academic grade). This is due at least in part to the nature of a tenured post in a research-intensive institution. Academics are required to produce research of international standing, to teach and provide tutorial and pastoral support to students and to participate in University and – at Oxford, college – administration. There is evidence that women, more than men, see such multi-faceted roles as 'undoable'[9]

b) Issues particular to STEM

a. The nature and organisation of scientific work

18. The Royal Society of Edinburgh report discusses the 'nature and organisation' of academic science and argues that the pressures inherent in academic work are even greater in STEM, in particular in experimental work. For example:

- experiments often have to be run and supervised outside normal working hours
- the pace of change in science and technology is faster, meaning that competitive pressures to publish are even greater
- there is considerable pressure to be visible and to participate in international conferences to further a career.

Taken together, these factors make it difficult for scientists to interrupt a career for any time, as knowledge and skills become out of date after even short periods away from work.

19. A recent article in the Journal of Evolutionary Biology[10] discusses the issue of visibility, noting that, while women were significantly under-represented among invited speakers, this was in part attributable to a larger proportion of women than men declining invitations. The article notes that this leads not just to detriment to individual careers but also to women's research in general being less visible. A subsequent on-line discussion suggested that women use child care as an excuse not to attend conferences - but that their real reason for declining to participate is because they find the male-dominated culture uncongenial[11]

20. A number of studies have found that the perception - or reality – that the career structure of science is incompatible with family life is the main reason for the attrition of women from academic STEM:

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[9] *"Not doable jobs!" Exploring senior women's attitudes to academic leadership roles*, C. Chesterman, A. Ross-Smith, M. Peters, Women's Studies International Forum, vol. 28, no. 2, pp. 163-180, 2005

[10] *Fewer invited talks by women in evolutionary biology symposia,* Schroeder et al., Journal of Evolutionary Biology, vol. 26, no. 9, pp.2063–2069, September 2013

[11] http://occamstypewriter.org/athenedonald/2013/07/17/conferences-childcare-and-uncomfortable-stereotypes/

- A large American study[12] found that family formation – most importantly marriage and childbirth – accounts for the largest leaks in the pipeline between PhD receipt and the acquisition of tenure. Women scientists who are married with children were found to be 35% less likely to enter a tenure track position after receiving a PhD than married men with children and, upon entering a tenure-track job, were 27% less likely than their male counterparts to achieve tenure.

- There is some evidence that the 'two body' issue is greater in science: scientists are more likely to be married to other scientists; and the male partner's career more often takes precedence. It is also infrequent in the UK to offer dual career postings, while they are relatively common in the US, making it difficult to attract senior female scientists to positions here.

21. However, it is clear that the lack of career progression is not solely attributable to family and caring responsibilities. The US study found that, while single women without children are only 2% less likely than married men with children to enter a tenure track position, they are 23% less likely to achieve tenure, reflecting the gendered nature of science in general.

b) The gendered nature of science

22. Many science disciplines in the UK have been dominated by men for longer than other fields: even in 1991 there was still only one female Professor of Physics in the UK. This has - inevitably - led to gendered science cultures, reinforced by the primacy of peer assessment in academia. Both male and female scientists hold stereotypical views of what it means to be a scientist and those views play out in decisions about recruitment, progression and the assessment of research excellence. Both women and men hold negative views of women who occupy stereotypically masculine roles and judge women to be less successful in male jobs:

    - Two US studies found that women were described as more 'communal' (tactful, sensitive, helpful) and less 'agentic' (assertive, dominant, ambitious) than men in the reference letters that are central to many hiring decisions; and that communal characteristics have a negative relationship with those decisions.[13]
    - Ahlqvist, London and Rosenthal[14] found that women in a minority in a non-stereotypical role (e.g. a female engineering Professor) feel a strong internal disconnect between their actions and how they feel they are expected to act.

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[12] *Staying Competitive: Patching America's Leaky Pipeline in the Sciences*, M. Goulden, K. Frasch, M. A. Mason, The University of California, Berkeley, Berkeley Center on Health, Economic, & Family Security and The Center for American Progress, November 2009

[13] *Gender and letters of recommendation for academia: Agentic and communal differences*. J. M. Madera, M. R. Hebl, R. C. Martin, Journal of Applied Psychology, vol. 94 no.6, pp. 1591-1599, November 2009

[14] *Unstable Identity Compatibility: How Gender Rejection Sensitivity Undermines the Success of Women in Science, Technology, Engineering, and Mathematics Fields,* S. Ahlqvist, B. London, L. Rosenthal, Psychological Science, Early Publication online doi: 10.1177/0956797613476048

- A recent randomized double-blind study[15] showed that both male and female academics consistently rated the identical applications of students who had been allocated a male name ('John') higher than those who had been allocated a female name ('Jennifer'); rated the 'male' applicants as significantly more competent; selected a higher starting salary for them; and offered them more career mentoring.

23. Within many science disciplines, work is organised into large research groups, which are often described as having a 'sink or swim' culture, with few formal reporting or support mechanisms. The evidence is that the absence of such mechanisms is largely neutral for men, but has a significant negative effect for women, who place a higher value on structured support. Mentoring, careers advice, work placements and regular feedback all help from the earliest stages to develop women's confidence as a scientist and their self-concept.

24. This effect may be felt more keenly in a research-intensive university with an internationally diverse workforce with a diversity of gendered expectations and stereotypes about the role of women in STEM. In seeking to create a more supportive culture, many departments are tackling cultural barriers which may not be perceived as difficulties elsewhere. Measures to support women have to address not only the gendered expectations prevalent in the UK, but also those held by both men and women from countries where female scientists are even less likely to progress to senior roles.

c. Environmental issues (e.g. culture, health and safety)

25. A 1999 study on the factors affecting the career choices of chemistry graduates[16] found that women were deterred from staying in academic chemistry largely by environmental factors, including poor working conditions and cavalier attitudes to health and safety. While conditions are likely to have improved since, environmental factors still weigh heavily for many women, particularly if the overall culture is perceived as hostile, for example, long hours spent at the bench or at a fume cupboard.

d. Low numbers of women

26. The low numbers of women in many disciplines in itself reinforces the problems for women in those departments:

- Women consistently report that they have few 'ordinary' role models available: women who are juggling a career in science with some form of work-life balance and/or having a family. There is a perception that to

[15] *Science faculty's subtle gender biases favour male students* CA Moss-Racusin, J.F. Dovidio, V.L. Brescoll, M.J. Graham and J. Handelsman Proceedings of the National Academy of Sciences Vol. 109 pp.16474–16479, 2012 http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3478626/

[16] Factors Affecting the Career Choices of Graduate Chemists, 28 February 2000, Royal Society of Chemistry

succeed in a STEM career, women have to be 'super-human' which deters many from staying.

- The dearth of women means a lack of female mentors for graduate students and early career researchers.
- The few women who remain tend to be over-burdened with administrative and other roles because of the need to appoint women to selection and review panels and committees – thereby adding to their non-research responsibilities and increasing the likelihood of them leaving.
- The lack of women perpetuates the masculine culture of many science departments, in turn deterring female undergraduates and graduates from remaining in academia.

27. The lack of a critical mass of women, within disciplines and across the institution as a whole, both perpetuates many of the cultural barriers which are at the heart of the problem and makes it more difficult to introduce the cultural changes needed to make progress.

c) The gendered nature of work and family

28. We have focused on the constraints particular to academia and to STEM, but some of the factors affecting progression are common to women in all careers and reflect the different life and career choices women and men make – whether freely or because of societal norms. The difficulty in STEM is what has been called the 'accumulation of disadvantage' – women are tackling not one but several handicaps and may reach a point where the cumulative difficulties inherent in remaining in academia outweigh the attraction of the science.

29. Within professional careers in general:

    - women are more likely than men to work in careers more closely aligned with their values – as evidenced by the predominance of women in senior positions in the not-for profit and voluntary sectors in the UK;
    - regardless of whether they have children, women apply to and remain in jobs with a better work-life balance

30. Childcare in the UK remains largely gendered. Despite recent legislative changes, shared parental leave is unusual and women take relatively long periods of maternity leave and men a maximum of two weeks of statutory paternity leave. Women continue to take the primary responsibility for child care beyond the early years (three quarters of mothers say that they have primary day to day responsibility for childcare[17]), reinforcing stereotypical assumptions in STEM about women's roles and commitment to science. The long-hours culture places women with continuing child-care responsibilities at a further disadvantage for a substantial portion of their career.

[17]http://www.equalityhumanrights.com/uploaded_files/research/15._work_and_care_modern_parents_15_report.pdf

2. 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?

31. We do not have a robust evidence base on the career destinations of women leaving STEM but note that many of the learned societies (Institute of Physics, Royal Society of Chemistry etc) hold such data.

32. It is important that there are scientifically trained men and women in all areas of society that require evidence-based decision-making. It also helps perceptions of science as a female career if female scientists are prominent in areas such as government, the media and education. What is important is that women do not continue to leave academic science in higher numbers than men for negative reasons.

3. 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?

33. The range of factors affecting entry to, and attrition from academic STEM, and the dynamics between them, mean there is no single or simple solution. We suggest below a range of actions which collectively would address some of the disadvantages women face. However, much of the problem is intrinsic to the competitive and short-term funded nature of international science; and the gendered nature of career and family choices in the UK, and is not amenable to easy resolution by the UK alone. The EU has done much to address inequalities in science and science funding and we support their efforts through participation in work by LERU. Their recent publication[18] provides a useful analysis of the issues.

University action

34. While there are some generic issues, the organisation of work and the resulting culture varies by department and institution. We believe that initiatives such as Athena SWAN and equivalents provide the best vehicle for introducing the necessary cultural changes, by requiring individual departments and institutions to address these cultural barriers through reflecting on the evidence of attrition in their context; consulting women locally on possible solutions; and engaging men with those solutions; and identifying actions over the short, medium and long term.

35. At Oxford, all our science and medical science departments will have applied for an Athena award by April 2014 and the majority are committed to applying for a Silver award by 2015. At institutional level, we announced in July 2013 a £1million Fund for Diversity which will support activity to address gender equality that requires additional funding and commitment. For example, we have piloted using EPSRC grant funding an innovative maternity returners scheme which gave women on or immediately after maternity leave small awards to fund the activity they identified as best helping to keep their career on track. The Fund will allow us to extend this type of support more widely and mitigate the risk of women leaving Oxford at this vulnerable stage in their

[18] Women, research and Universities: Excellence without gender bias. July 2012.

career, while also enabling us to make larger structural changes across the University.

36. The University has recognised the need for affordable and accessible childcare in order for women to progress in science and nursery provision at Oxford has doubled over the last two years. The University has the highest level of childcare provision in UK higher education, with 429 places across 12 sites, plus four college nurseries. It offers a salary sacrifice scheme for payment of nursery fees, offers a childcare voucher scheme, and works in partnership with external providers to support parents during the school holiday periods.

37. The University recognises the need to support all research staff in STEM and works with departments and research staff to promote full implementation of the Research Staff Concordat through Oxford's own Code of Practice for the Employment and Career Development of Research Staff. The University also applied successfully in 2011 for the European Commission's Badge for HR Excellence in Research.

38. Other examples of support for female researchers and academics in STEM include:

    - Tailored support from the Careers Service for female researchers, including a termly 'Women in Academic Careers' event.
    - The Springboard women's development programme which is currently run six times per year for all staff, is promoted to female researchers, to support them in developing the confidence to remain in a research career.
    - Oxford Females in Engineering, Science and Technology (OxFEST) - a student-led society with 800 members that aims to provide a support network for all women in science at OxfordMentoring and networking opportunities are provided through:
        - Regular speaker events, socials and skills development sessions
        - A mentoring scheme open to all members
        - An annual Symposium
        - A Facebook page and website
    - Support for women from Oxford University Clinical Academic Graduate School (OUCAGS) including:
        - The Women in Academic Medicine Support Programme for academic clinical lecturers (ACLs), which provides regular networking opportunities and career development sessions. Feedback from the women involved is that they welcome the opportunity to meet as a group.
        - A group mentoring scheme for academic clinical fellows (ACFs) and ACLs.
    - An informal group of female academic scientists who meet termly to network and offer mutual support.
    - The introduction of cross-divisional mentoring schemes for researchers in our science divisions bringing together researchers from different departments in a small-group mentoring model.

Department action

39. We summarise below a range of best practice adopted by individual departments at Oxford as a result of their commitment to Athena SWAN:

- Providing post-docs with a month free from lab work to write their next application; or bridging funding of three months/a part-time position to sustain their research career between external contracts.
- Providing targeted scholarships to enable talented students from under-represented groups, including women, to continue to a fourth year of undergraduate study[19].
- Encouraging and supporting female research staff to apply for independent fellowships through identifying potential high fliers, mentoring them through personal interviews with the Head of Department, reviewing draft applications and giving help in preparing for interviews.
- Introducing transparent workload mechanisms which ensure the equitable allocation and rotation of administrative and pastoral duties.
- Ensuring that recruitment and interview timing allows for any family commitments (both for the interviewees and selection panel).
- Introducing core hours of 10.00 to 4.00 for departmental meetings or seminars which research staff are required to attend.
- Giving applicants for posts the opportunity to meet current members of the department with similar family responsibilities.
- Taking full account of career breaks in all recruitment processes.
- Actively encouraging female students from countries where women are not traditionally encouraged to be assertive to take Springboard courses and receive additional mentoring from their supervisor, with a focus on critical analysis of the literature and scientific writing skills.
- Improving and updating their portraiture and websites, ensuring gender balance in their seminar series, inviting senior women to give named lectures, running 'Women in Science' lectures and lunches.

4. What role should the government have in encouraging the retention of women in academic STEM careers?

40. We believe that the government can help address the structural issues through:

- Protecting science funding to enabling Research Councils and others to provide:
    - more long term Fellowships, which help women to remain in science by bridging the post-doc/tenured post transition at which women are most likely to drop out
    - more flexible/part-time Fellowships
    - bridging schemes for women returning from maternity who may not have been able to line up the next contract.

  Attaching funding to the individual rather than the institution helps women with career mobility.

- Ensuring that all Research Councils fully cover all costs of maternity across all grant funding, including for extensions, and for Principal Investigators.

[19] http://www.campaign.ox.ac.uk/news/gillies_scholarship.html

- Requiring all grant funders in receipt of public funding to monitor and report on the gender balance of awards, including measures to solicit and support applications from female scientists.
- Providing additional core funding for initiatives such as Athena SWAN so that the Equality Challenge Unit (ECU) is fully resourced to support universities in embedding such initiatives.
- Supporting the Higher Education Statistics Agency (HESA) and ECU to provide high quality, accessible benchmarking data by discipline so that institutions and departments can easily measure their progress in tackling gender inequality in STEM.
- Maintaining the Public Sector Equality Duty which requires institutions explicitly to consider the impact of all their policies and actions on women (and other protected groups).
- Ensuring that institutions are held accountable for progress in addressing gender equality in sensible and constructive ways: the explicit allowance in the REF2014 for individual circumstances is helpful here.
- Recognising that in many subjects the issue is one of entry to science – which needs sustained action in schools, on the lines of that recommended by the Institute of Physics[20] including ensuring the curriculum is equally attractive to girls and boys at all stages.
- Monitoring and reporting on the impact of recent changes to parental pay and leave, and making further progress toward the Scandinavian model of maternity and paternity which is shared equally between both partners on the 'use it or lose it' model. Equalising parental leave and pay would help reduce the perceived risk of hiring women who want to have a family.

41. The Davies' report on women on Boards was helpful in increasing the proportion of women on company boards. We believe the government should consider establishing a similar high profile and prestigious initiative on women in science.

August 2013

[20] http://www.iop.org/education/teacher/support/girls_physics/file_58196.pdf