Science Council response to the Royal Society of Edinburgh inquiry into barriers to women in STEM

The Science Council welcomes the opportunity to provide evidence on this important issue and commends the Royal Society of Edinburgh for establishing the Working Group. If gender balance in the science workforce is to be achieved, the STEM communities must continue to ask themselves probing questions such as those set out for this consultation.

The Science Council

The Science Council is an umbrella organisation of over 30 learned societies and professional bodies in the UK drawn from across science and its applications: a list of member organisations is attached in Appendix 1. One of the Science Council's key objectives is to work towards a UK science workforce that reflects society's diversity.

There is evidence of continuing progress in encouraging women to study sciences beyond 16 and into science careers.

In terms of visibility within the learned societies and professional bodies, there has been an increase in the number of member bodies of the Science Council that have had at least one female President. We have also seen an increase in the number of female chief executives from 2 (7%) in 2005 to 11 (32%) in 2011. The visibility of female case studies and role models has also increased substantially with a number of different programmes targeting this area of activity.[1]

1. What do you see as the opportunities and challenges facing the STEM workforce in Scotland today?

STEM workforce

The consultation does not define the STEM workforce. The background information for the inquiry makes reference to the failure of female STEM graduates and post graduates to proceed to senior positions in universities, research, business and industry and to the wasted investment that this represents.

Data suggests that 51% of STEM graduates do not enter scientific occupations. Research published by the UK Department for Business, Innovation and Skills (BIS) in March 2011, *STEM Graduates in Non-STEM jobs,*[2] found that there were a variety of reasons for this but that one of the key issues was the difficulty in defining STEM employment in the absence of a generally accepted definition of what comprises either a STEM job or STEM skills: neither Standard Occupational Classification (SOC) system codes nor Standard Industrial Classification (SIC) codes are particularly helpful. It is worth noting that this research, which was focused on recent graduates and post-graduates, did not identify any strong gender differences. The research found that individuals were in many cases consciously choosing to study undergraduate degrees in STEM subjects as a means of accessing careers unrelated or only loosely related to STEM as they had identified the premium employers place on STEM degrees.

[1] http://www.sciencecouncil.org/content/role-models-and-case-studies-report
[2] http://www.bis.gov.uk/assets/biscore/further-education-skills/docs/s/11-771-stem-graduates-in-non-stem-jobs.pdf

The Science Council has been exploring this issue in a number of ways in order to try to better understand why so many STEM graduates appeared to have chosen to work in other sectors of the economy. Following a review of the types of roles undertaken by Chartered Scientists it has produced summary profiles of 10 types of scientist[3] which begins to illustrate the different ways in which STEM qualifications and skills are used in the economy. It is significant that for most people the term 'scientist' is narrowly associated with careers in academic or research environments. These roles are a small proportion of the overall STEM workforce (approximately 32,000 in academia and a smaller number elsewhere) and it has therefore been helpful to use the 10 types to monitor the range and breadth of case studies available, for example in STEM careers information, internship and work experience opportunities, and widening participation projects. It is also clear that not all of these roles would be classified as 'scientific' in SOC codes, but the exercise serves to illustrate how important science knowledge and skills have become in almost all areas of the economy and society.

Workforce analysis

The Science Council recently commissioned research to understand the UK science workforce and identify those working in science at all levels. The research has provided comprehensive data on the current UK science workforce[4], profiling employment across the skills levels and providing a view on the future workforce and where demand is likely to be highest. Unlike previous methodologies that focused on a relatively narrow band of science or engineering employment sectors, this research uses a new analysis that enables the identification of the science workforce across the entire economy regardless of the employment sector. New definitions were established of primary science workers, secondary science workers and non-science workers and the sectors were classified as core science, related science and non-science (see Appendix 2). Key findings were:

- There are 5.8m people employed in the science workforce in the UK with 37.4% of those located in the South East, East and London.
- Health and education sectors employ 60% of the science workforce
- Overall the primary science workforce has a gender balance of 60/40 male/female (close to the UK working population of 54/46 male/female). Within the primary science workforce a number of subsectors have significantly higher proportions of male employees, including ICT where 91% are male
- In the secondary science workforce the gender balance is 44% male to 56% female. In sectors such as textiles, health, pharmaceuticals and education a far higher proportion of women work in secondary science roles than in primary science roles.
- The gender balance for primary science workers in non-science sectors is strikingly different with 73% male to 27% female.
- Science workers employed in non-science sectors are generally paid less than their peers in science based sectors.

This research has presented a different picture of the employment of women in the workforce to that shown in the UKRC data of 2010[5] which identifies that only 5.3% (674,000) women are employed in any SET occupation, compared to 31.3% for all working men, in a total of 5.5 million women and men in SET occupations.

Appendix 2 provides charts of the data available for Scotland specifically, although the sample sizes involved do not allow for any further granularity in the analysis but do quantify gender disparities in various sub-sectors of STEM and help to illuminate some pipeline issues through the age distribution. We will be happy to forward a copy of the full report as soon as it is published and we would be pleased

[3] http://www.sciencecouncil.org/content/10-types-scientist-%E2%80%93-science-jobs-are-not-all-same
[4] The current and future UK science workforce, TBR report prepared for the Science Council, 2011
[5] http://www.theukrc.org/resources/key-facts-and-figure s

to provide access to the data if it was thought to be helpful. We would also welcome feedback from the Working Group to add context to the data and any input on how future such workforce studies might cover gender issues more directly.

Employment sectors - SMEs

The BIS Science for Careers Expert Group[6] identified an additional issue to be considered in looking at employment opportunities in STEM industries and this was the low visibility of small and medium sized enterprises (SMEs) in terms of STEM employment. The Science Council has recently commissioned research that has identified that 58% of STEM graduates are working for SMEs. This clearly has an impact on the visibility of women in STEM as for the most part data and case studies for female participation is collected from larger employers and the more visible STEM sectors such as universities and research establishments. It also has impact on the ways in which support for women in STEM is delivered in terms of professional development, networking and flexible working. [7]

2. What do you see as the current barriers to the recruitment, retention and progression of women in the STEM workforce?

The Lord Davis's report for BIS, *Women on Boards* [8] identifies a number of factors preventing women reaching senior positions on corporate boards, including: a lack of flexible working; difficulty in reaching an acceptable work-life balance within a long-hours culture; and disillusionment at their lack of career progression. Many of these factors will also be present in the STEM workforce. For example, a lack of part-time roles available at more senior levels in STEM and the perceived effect of part-time working on progression, may well perpetuate the issues. There remains much yet to be done to ensure that employers in the STEM sectors facilitate career breaks for women, support returners and increase the ability of both men and women in the STEM workforce to progress their careers alongside family responsibilities. We know, for example, that in the UK, part-time work is often 16-18 hours per week and is more common in low paid and low skilled jobs and that part-time work is typically less available in higher grade occupations. However, in Scandinavia, part-time work can commonly mean up to 30 hours and is more frequently available for employees working in managerial, professional and technical roles. It is believed that this accounts for some of the lower gender pay gap in Scandinavian countries when compared with the UK, which suggests that more flexible working practices could be integral to reducing gender inequalities.[9]

This issue is compounded by the challenge that a first independent fellowship or permanent position will often be taken on around the age that women are starting a family.[10] Looking forward, it would be helpful to understand how well STEM sectors are performing on these issues relative to each other and to the wider economy.

Progression post 19

While gender differences in numbers choosing to study STEM subjects post 19 appear to be closing there remain significant variations in some areas, including physics and STEM related vocational training.

- Overall there are slightly more men than women doing STEM subjects in HE
    - women outnumber men in Medicine and Dentistry, Subjects Allied to Medicine, most Biological Sciences, Veterinary Science, Agriculture and Related Subjects

[6] http://interactive.bis.gov.uk/scienceandsociety/site/careers/files/2010/03/BIS-R9199-URN10-767-FAW.pdf
[7] http://www.equalityhumanrights.com/uploaded_files/research/16_flexibleworking.pdf
[8] http://www.bis.gov.uk/assets/biscore/business-law/docs/w/11-745-women-on-boards.pdf
[9] http://www.equalityhumanrights.com/uploaded_files/research/16_flexibleworking.pdf
[10] Prof Athene Donald, Unlocking potential – The Smith Institute June 2011

- men still out-number women in Physics, Chemistry, mathematics, Computing Science, Engineering, Architecture, Building and Planning
- for those entering HE through non-A Level routes, men are considerably more likely to do STEM in HE than women
- But women out number men in HE in almost all other areas

The experience of science within school is clearly very important in influencing the recruitment of girls in to STEM.

- The Institute of Physics has undertaken research in this area [11] and advises teachers to work to highlight the links between topic areas, to avoid fragmenting the curriculum and to show the progression of ideas. The contexts used to present curriculum topics should also take account of the interests of both boys and girls and to emphasise the relevance of science to young people both in their immediate lives and for future careers. Both the use of role models and careers education which challenges stereotypes are important in supporting good teaching. Teaching resources from the Science Council's own Future Morph careers website utilize a wide range of text and video case studies[12], as does careers material from member bodies such as Spotlight on Careers[13] by the Royal Meteorological Society or Physics.org[14] from the Institute of Physics.

3. What steps are being taken within your organisation and/or sector to enhance the career options and progression routes for female staff members?

Professional bodies and learned societies recognise that they have a key role to play in developing and supporting women pursuing careers in science. Almost all Science Council member bodies have specific programmes and activities which aim to support women in science but the majority of these programmes are UK-wide in scope. Some examples of the specific programmes for Scotland are:

- the BCS the Chartered Institute for IT, which has run its BCSWomen egroup for over ten years and holds regular events for women including in Scotland
- the Royal Society of Chemistry has a women members network with regional events in Scotland.
- the Institute of Physics has been very active for many years in Scotland through research and providing support, this has included site visits for university physics departments and resources for school teachers.

<u>Leadership</u>

The Science Council recognises that there must be leadership within the sector if the issues of gender and diversity in the STEM workforce are to be overcome. It has itself established as one of its key areas of work the aim of ensuring that the UK science workforce reflects society's diversity, and has embedded this within its own activities, including:

- Careers from Science project that includes the Future Morph web site. It is important that providers take account of gender issues in the provision of careers information. This Science Council project develops and shares good practice on all aspects of diversity in STEM careers information and is also working towards greater geographical and regional information resources.
- A benchmarking exercise has been established to enable professional bodies to work towards systems that capture data on gender and other aspects of diversity, including geographical, and thus to enable activities to be evaluated and progress towards wider participation can be monitored.

[11] Girls in the Physics Classroom: An action guide for teachers, Institute of Physics Dec 2006
[12] http://www.futuremorph.org/teachers/science_teaching_resources.cfm
[13] http://www.rmets.org/activities/careers/spotlight.php
[14] http://www.physics.org/careers.asp?contentid=381

- The Science Council is encouraging innovation in practice such as supporting the appointment of younger scientists from under-represented groups to entry-level committees and working groups in order to support career progression and visibility; encouraging the re-scheduling of conferences and other meetings to enable those with family responsibilities to attend more easily; and sharing good practice in nominations and appointment practices.
- Research commissioned into the breadth and range of STEM case studies and role models available on the web found that there was now a good range of female case studies but that gaps existed for some discipline/subject areas and for non-HE routes to STEM careers.[15]

Women professional scientists

The Science Council considers that there has been positive progress towards achieving improved gender balance in the science workforce in recent years. For example, the Register of Chartered Scientists is now 29% female, and over 50% of Chartered Scientists under the age of 35 are women - this trend is continuing and is reflected in new registrations.

At present, geographical data on Chartered Scientist registration is not collected but the Science Council is aiming to introduce this as one of its key diversity measures. The current bench-marking data collection of Member Bodies is also seeking geographical information on membership.

Leadership and working in partnership

Leadership is necessary from within STEM if good practice is to be embedded across the sectors. This will not necessarily mean that gender must be separated from wider diversity issues, and indeed there is potentially much to gain from embedding ambitions regarding women's participation in STEM within the wider programmes. However, it will still be important for there to be a pan-STEM UK-wide approach to the issues, especially with regard to collection of data and monitoring progress. With the demise of the UKRC it remains unclear how this will be achieved: we understand from BIS that the intention is that the Royal Academy of Engineering will provide leadership and development for engineering and technology, and the Royal Society will do the same for science.

It should not be forgotten that there are a very large number of organisations working to increase the numbers of women in the STEM workforce. Many of these organisations focus on a single aspect of the issue such as an employment sector, geographical area, age group or similar. Many are very effective in this and Science Council member bodies are some excellent examples. Overall these smaller organisations provide a huge resource of primarily voluntary effort in a complex field. They are able to respond to the needs of women and support, mentor and champion the role of women in science. Their specialist knowledge and links enable them to respond to the specific circumstances in their sub-sector in a way that a universal pan-STEM, UK-wide organisation cannot: for example, there are specialist organisations working with returners in academia; others work only in ICT, or for BME women, or in biosciences, public sector or a specific geographical location; some focus on supporting young aspirant women scientists and engineers and others produce specialist careers information and web support for those still in secondary education. The range is certainly diverse.

Many of the smaller specialist organisations feel undervalued, isolated and marginalised from government and from the larger public sector led initiatives and yet they have continued to offer a wide range of services and support for women across the UK. Most are not engaged directly with either the Royal Academy of Engineering or the Royal Society. It will be important that a central point of contact and network is established as we move forward, and that this central resource is able to facilitate and encourage the smaller specialist organisations to work together and to share expertise, resources and insights. The RSE might usefully facilitate this in Scotland, providing some leadership but also incentives for smaller organisations to work collectively.

[15] http://www.sciencecouncil.org/content/role-models-and-case-studies-report

4. What further steps could/should be taken within your organisation and/or sector, including any specific policies and practices?

The Science Council is currently looking at the possibilities for further action to address this problem and is consulting with member bodies and others. For example, in work it is undertaking towards the development of new professional registers for technicians and scientists at intermediate levels, the Science Council will be undertaking a review of training and qualification routes to ensure that they are appropriate and accessible for all. This will include a review of apprenticeships: there are currently very few apprenticeships in science occupations and this qualification route seems to appeal less to women[16].

Further areas of potential development include:

- formal and informal mentoring schemes using networks of members[17]
- targeted career development programmes
- schemes to raise the profile of women within the organisations
- sharing of good practice in promoting women to senior appointments within voluntary organisations
- benchmarking individual organisation's performance within the sector

To support this work a further benchmarking exercise is being undertaken across our member bodies to explore structures with the aim of identifying and sharing good practice: for example, we know already that some organisations already support career breaks through reduced fees or payment breaks which may be a key way for individuals to stay in touch with a profession. The Science Council is also exploring what range of services might be offered by the 21st century professional body. This project is consulting a wide range of different types of membership organisations to identify the services that will most encourage growth and participation. The project aims to enable science professional bodies to develop the services and cultures that will support wider participation in the science workforce as well as ensure their own future sustainability. For example, we already know that science professional bodies have difficulty in retaining younger members, that the most commonly offered service is subscriptions to publications, and that few professional bodies have services specifically designed to meet the needs of technicians in science.

Education

Recent research[18] into the career aspirations of young people is indicating that stereotypes and self identity in relation to science careers is well developed by the age of 11. This work suggests that the STEM sector should consider how it can work with primary aged children to ensure they develop a positive view of the opportunities available from STEM which is not limited by gender. Careers education and information, advice and guidance is important in supporting informed qualification and career choices: however, this can be more powerful when coupled with a positive workplace experience which reinforces gender equality.

The Science Council's own Careers from Science project[19] identified the need to ensure that parents are also comfortable with STEM as a positive career choice since they often have a strong influence on the choices their children make. For example, we are aware that some parents will be wary of encouraging their daughters to enter male dominated sectors for fear of discrimination or simply a less welcoming work environment. The Science Council has included information for parents on our STEM careers

[16] The Science Council will be seeking the gender data on apprenticeship take up from BIS.
[17] The MRC supported Suffrage Science project encouraging leading women bio-scientists to mentor future scientists would be an example of a more informal project style of mentoring that also raises the profile of leading women scientists. http://www.csc.mrc.ac.uk/PublicScience/FabricsOfLife/SuffrageScience/
[18] "Doing" Science versus "Being" a Scientist, Archer et al, 2010
[19] http://www.sciencecouncil.org/content/careers-science

website, Future Morph[20], and we are seeking funding to expand our reach to this audience to work with parent and family networks. As part of this we recognise there will be a need to develop appropriate messages for different cultural groups, some of which may see certain career paths as less appropriate for women.

5. More generally, how could the potential of women in the STEM workforce be more effectively and efficiently realised? Who would be responsible for implementation and what support would be required?

There is some anecdotal evidence that women are attracted to working in areas of science with a multidisciplinary approach and where the application of the science is clear. It would be useful to investigate this further and if research supports the proposition, to consider the implications for school level science.

Rather than resorting to enforced quotas Davis[21] recommends improving transparency with organisations being expected to report on the numbers of women present at senior levels. This is an approach that would be easy to adopt across STEM organisations and could help to focus attention and effort.

6. Do you think there needs to be any changes to existing employment law? If so, in what areas?

We have no proposals to make with regard to amending legislation.

7. Are you aware of any existing resource that is effective in addressing the under-representation of women in STEM?

The factors affecting the participation of women are varied, complex and often interconnected therefore a range of measures and resources are needed to effect change. There are many good resources available and in addition to those already mentioned the two projects below are worthy of note.

The Daphne Jackson Trust awards Fellowships to enable scientists, engineers and technologists to return to work following a career break. Many Science Council members support the Trust which has an excellent record of success and would benefit from greater financial support.

As part of their government funded careers and subject choice project Sheffield Hallam university produced an Equality and Diversity Toolkit, http://www.stem-e-and-d-toolkit.co.uk/ , to aid the promotion of STEM careers to 11-16 year olds. This comprehensive resource collects together a wide range of information and practical support.

Science Council
32-36 Loman Street
London SE1 0EH
19th August 2011

[20] http://www.futuremorph.org/
[21] http://www.bis.gov.uk/assets/biscore/business-law/docs/w/11-745-women-on-boards.pdf

Appendix 1

Member Bodies of the Science Council
August 2011

Association for Clinical Biochemistry
Association of Neurophysiological Scientists
Association for Science Education
British Academy of Audiology
British Computer Society
British Psychological Society
Chartered Institution of Water and Environmental Management
Energy Institute
Geological Society of London
Institute of Biomedical Science
Institute of Brewing and Distilling
Institute of Clinical Research
Institute of Corrosion
Institute of Food Science and Technology
Institute of Marine Engineering, Science and Technology
Institute of Materials, Minerals and Mining
Institute of Mathematics and its Applications
Institute of Physics and Engineering in Medicine
Institute of Physics
Institute of Professional Soil Scientists
Institution of Chemical Engineers
Institution of Environmental Sciences
London Mathematical Society
Mineralogical Society
Nuclear Institute
Oil and Colour Chemists' Association
Royal Astronomical Society
Royal Meteorological Society
Royal Society of Chemistry
Royal Statistical Society
Society for General Microbiology
Society of Biology
Society for Cardiological Science and Technology
Society of Dyers & Colourists

Appendix 2

Extracts from *The current and future UK science workforce* Report prepared for the Science Council by TBR, 2011

This research uses a new analysis considering the science workforce across the entire economy, rather than looking at total employees within science based industries. This innovative approach enables an understanding of the true size and scope of the science workforce across the economy, rather than limiting the research to considering scientists working in a narrow band of science sectors.

The definitions of the science workforce used for this report are:

- Primary science workers: workers in occupations that are purely science based and require the consistent application of scientific knowledge and skills in order to execute the role effectively.
- Secondary science workers: workers in occupations that are science related and require a mixed application of scientific knowledge and skills alongside other skill sets, which are often of greater importance to executing the role effectively.
- Non-science workers: workers in occupations that are not science based and have no requirement for science based knowledge or skills.

Sectors are also classified as:

- Core science sectors: sectors that are primarily science based in their core activity.
- Related science sectors: sectors in which the primary activity is not necessarily science based, but has a strong relationship to science.
- Non-science sectors: sectors which have no science based or related activity.

Chart 1 Employment split by Sub-Sector, Region and Gender – Primary Workers

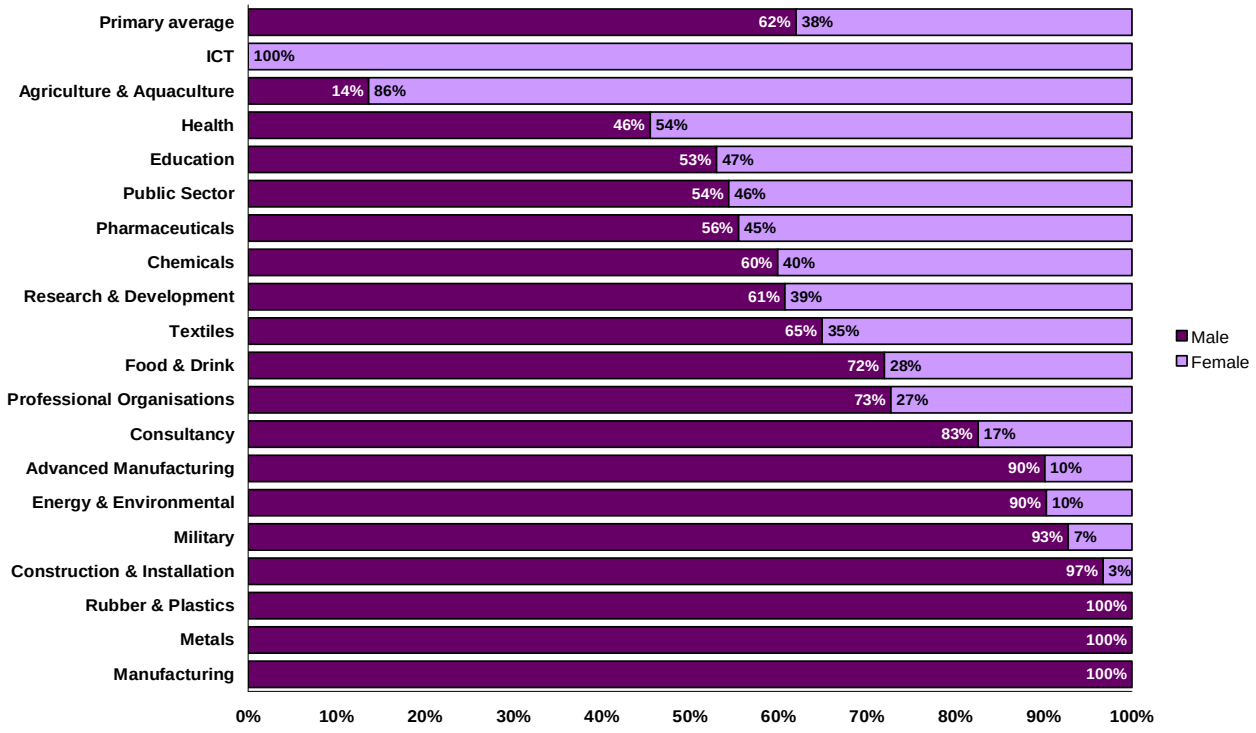

Chart 2 Employment split by Sub-Sector, Region and Gender – Secondary Workers