SUPPORTING GOOD PRACTICE IN UNIVERSITY MATHEMATICS DEPARTMENTS

Sean McWhinnie, Oxford Research and Policy

The London Mathematical Society (LMS) is launching a new report on *Good Practice in UK University Mathematics Departments* on 27 February 2013 at an event in the House of Commons. This highlights good working practice found in UK university mathematics departments with an emphasis on improving the recruitment, retention and progression of women.

Around 40% of graduates from UK first degree mathematical sciences courses are female. However, there is a significant drop-off in the proportion of women who become academic mathematicians, and only around 6% of professors of mathematics in the UK are female. Although all Science, Technology, Engineering, Mathematics and Medicine (STEMM) subjects suffer a drop in the proportion of women in senior positions, the fall off is particularly bad in mathematics.

The LMS Women in Mathematics Committee set out to support mathematics departments to improve working practices and the recruitment, retention and progression of women in academic mathematics, for example by working towards an Athena SWAN award.

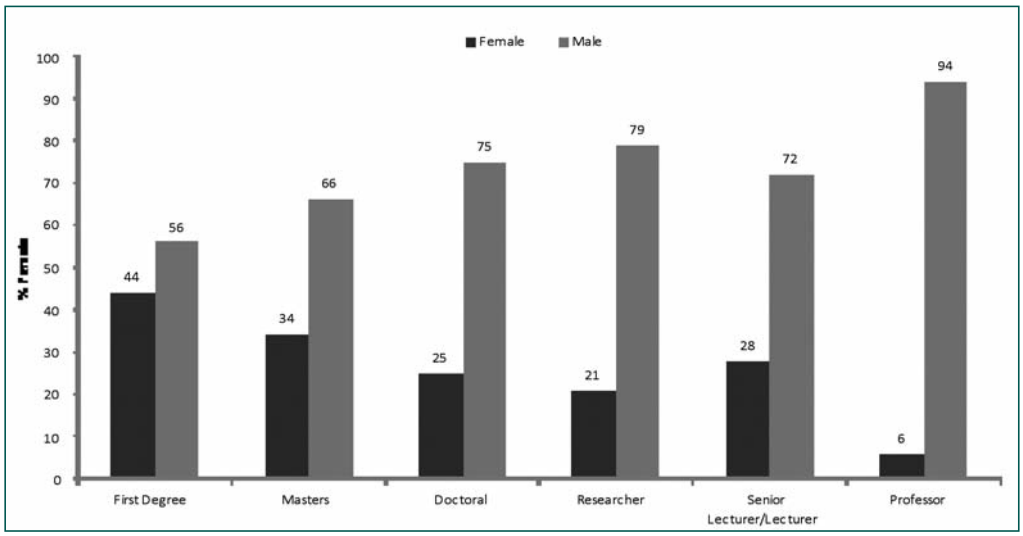

Figure 1 The mathematics pipeline for all nationalities in UK Higher Education Institutes - proportions of the populations at different stages who are male or female in 2011.

THE ACADEMIC MATHEMATICS PIPELINE

Figure 1 presents a snapshot of the mathematics pipeline for people of all nationalities who study mathematics or hold academic posts in mathematics in UK higher education.

The data illustrate that a smaller proportion of female students progress from first degree programmes to masters or doctoral programmes in UK higher education institutions (HEIs). 38% of mathematics staff who have only a teaching function in UK HEIs are female. If staff who have a research function as part of their contract are considered, the proportion of senior lecturers/lecturers that are female is 21%. In other words, women are significantly more likely than men to have teaching-only mathematics roles. The discontinuity illustrated in *Fig1* is explained by the numbers of women in teaching-only roles: if teaching-only roles are excluded then the proportion of researchers and senior lecturers/lecturers that are female is the same.

It is sometimes suggested that the reason that there are lower proportions of women at more senior academic grades is because there was a lower proportion of women graduating in the past. However, as illustrated in *Fig 2*, within a particular age range, the proportion of women academic staff in mathematics who are professors is much smaller than the corresponding proportion of men. For example, considering permanent academic staff in mathematics aged between 51 and 60 years in 2010/11, 58% of the male academics were professors compared with 22% of the female academics. The implication is that a smaller proportion of professorial-calibre women than men achieve their potential.

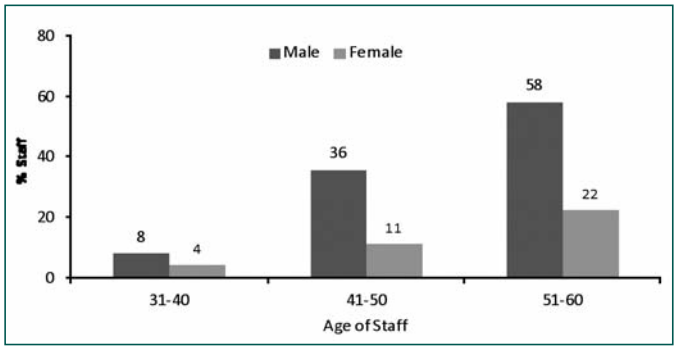

Figure 2 For each gender, the proportion of permanent mathematics staff in a specific age range who are professors (2010/11).

This shows that within mathematics a smaller proportion of women progress from undergraduate study to higher level study and that, among staff who gain academic posts, women are more likely to be in teaching only roles than men, and are less likely to be at more senior grades. This underlines the need for action to encourage a higher proportion of talented female mathematicians to stay in academia and to support those women to stay in research and progress in their careers. Similar patterns in respect of the progression of men and women are evident in other STEMM disciplines irrespective of the proportion of undergraduates who are female.

THE ATHENA SWAN CHARTER AND AWARDS

The Athena SWAN Charter is a scheme that recognises excellence in STEMM employment for women. It provides awards and opportunities to share good practice.

The Athena SWAN process ensures that all aspects of academic progress and careers are examined, with a focus on gender equality and opportunity, developing good practice in the recruitment, retention and promotion of women in university STEMM departments. Any HEI committed to advancing the careers of women in STEMM can become a member of the Charter, accepting and promoting the six Charter principles. The Athena SWAN Charter awards are for both institutions and departments. There are three levels of award Bronze, Silver and Gold.

Currently there are 85 HEIs that are members of the Charter and although almost 80 departments hold Bronze or Silver awards, there are only two mathematics departments that hold Silver awards: the Universities of Reading and Leeds.

The LMS Women in Mathematics Committee decided to engage with mathematics departments to improve their interaction with Athena SWAN. The LMS also wanted to provide guidance on the Athena SWAN process and to disseminate examples of good working practice already in place.

GOOD WORKING PRACTICES AND WOMEN IN SCIENCE

Research carried out looking at working practices in science, technology, engineering and technology departments [1] makes it clear that:

1. Good working practices benefit all, staff and students, men and women. However, bad practices adversely affect women's careers more than men's.
2. The best university departments do not target measures specifically at women because improved working conditions benefit all and make for a happy department. Good practice is not about how many women are in the department, it is about processes that are fair, flexible, accessible and transparent to all.
3. Departments with good working practices are able to attract and retain women better than other departments.
4. There is no evidence that the introduction of good practices adversely affects the excellence of the science carried out. Good practice equates with good science. In contrast the detrimental effects of bad practice build up incrementally over the course of a career resulting in a smaller proportion of women than men reaching their potential.
5. Leadership from the top, with the head of department acting as champion, is critical to changing culture, to making the changes stick and to changing behaviour. Simple changes to processes, which deliver clear benefits to staff, can start to change policy and behaviour, but without a head of department prepared to introduce changes and monitor adherence, little will change.
6. The age profile of the department, and the diversity of its staff, makes a difference. Young men and women with families have different expectations and needs from their older colleagues. Those younger staff's careers cannot thrive unless the culture of the department reflects the reality of dual career partnerships.
7. Successful action is based on good planning, which takes account of the department's academic plan and which is evidence based.

THE LMS PROJECT

The LMS distributed a questionnaire to all UK university mathematics departments, which requested information and examples of working practices around a number of key processes such as recruitment, induction, promotion, training, flexibility and career breaks, including maternity leave. Thirty departments returned completed questionnaires.

These were analysed to identify examples of good practice. These were used to provide the main content of the report. In addition, the practices described in the checklists were scored to benchmark each department. These were used to produce individual reports for departments, and to produce an overall summary for the LMS.

The departments that completed the questionnaires are at very different points in their Athena SWAN journeys and had varying working practices.

If we take the example of how a mathematics department 'ensures that the arrangements made for career breaks can enable individuals to maintain a career trajectory, which meets their circumstances, abilities and ambitions'. Departments with the best working practices demonstrate their ability to support staff to cope with the practicalities before, during and after a career break. Before a break, the best departments arrange a meeting to check that individuals are getting the support, advice and information they want and the department helps with support arrangements before, during and after the career break. Departments also recognise returners' needs, including flexibility, personal support, and mentoring. The head of department holds a meeting some weeks after an individual returns to discuss what support is needed.

The questionnaires revealed a division between those departments which had good systems in place and those that had little experience of staff taking career breaks and therefore took less formal approaches. A number had visible role models with experience of career breaks who were available to give advice, although there was also a view that expecting people in this position to support others was unreasonable. A few departments had formal

arrangements in place for cover, while some left it to the individual to make arrangements, and others dealt with it informally, reallocating responsibilities to others in their group. The best practice was where departments received a budget from the university for cover from sessional lecturers either during the maternity leave or for the period just after maternity leave, and where the arrangement was discussed in advance.

There were examples of good practice to support returners. One university had produced a good practice document on maternity returners. A number of departments work with individuals to ensure that they are given support. In one case staff were encouraged to meet with their line managers, as well as the head of department, before their return to discuss arrangements. In another case individuals taking parental leave were expected to have a staff development review on their return. There were examples of returning staff being given time to readjust to the workplace and to catch up with research through, for example, being given a term's grace from teaching responsibilities or being granted a period of study leave immediately following a period of maternity or adoption leave. Some departments also had in place arrangements to monitor returners on an ongoing basis. In one example during the phased return period the head of department met the member of staff weekly, to assess progress and identify any problems and to discuss future career progression. A number of departments also encouraged returners to take up flexible working arrangements.

The LMS hopes that by disseminating and highlighting the best working practices currently in place in mathematics departments, all departments will be encouraged to learn from the best and in doing so improve the position of women in mathematics.

References

1 Planning for Success - Good Practice in University Science Departments, Royal Society of Chemistry, London, 2008 (www.rsc.org/diversity); Women in University Physics Departments, Institute of Physics, London, 2006 (www.iop.org/diversity).

METHANE: THE UNNATURAL GAS

Dr Grant Allen
Lecturer in Atmospheric Physics, University of Manchester

Methane (commonly known as "natural" gas) is one of the major greenhouse gases (GHGs) recognised by the Intergovernmental Panel on Climate Change (IPCC). Molecule-for-molecule, methane (CH_4) is 23 times more potent than CO_2 and it accounts for ~7% of all GHG emissions in the UK (in 2009). Luckily, there is much less CH_4 in the atmosphere (on average) than there is CO_2 – about 200 times less. However, although the absolute concentration of CH_4 is currently relatively small, its potency means that even a small change in the total amount of methane in the atmosphere could be comparable to the global-warming impact of its more well-known counterpart. Just as importantly, CH_4 changes the way in which the atmosphere can naturally cleanse itself of pollutants, which can result in poorer air quality. Such changes could be under way.

One thing is certain – the atmosphere is (and always has been) changing. This change has historically been the result of natural perturbations, often (but not always) over long timescales. However, in recent history, mankind has been speeding up this pace of change with uncertain consequences. Whilst the general premise that climate-change-equals-global-warming is widely publicised, the more localised and extreme impacts implicit to climate change are often missed. For the UK alone, these impacts are thought to be more frequent extremes in weather of all types, hot and cold, dry and wet, windy and stagnant. This is because we are an island in the middle of the North Atlantic storm track – where energy is often racing fast from the equator to the poles. While no single weather event can ever be directly attributed to climate change (by virtue of the way climate and weather are necessarily treated differently within mathematical models), we rely on statistics over long timescales. The number of weather records broken in the UK over the past 7 years (and in 2012 alone) should not be forgotten, nor should similar statistics reported around the world. Whilst still the subject of debate, a growing number of meteorologists and climatologists are beginning to talk about climate change as something that has been having a growing impact on our weather (and our lives and economies) for many years.

The principal driver of climate change is an increased greenhouse effect driven by increases in the amount of GHGs in the atmosphere, which trap infrared radiation (heat energy) near the Earth's surface. Various feedback processes, tipping points and buffers are known (or thought) to exist, which may exacerbate or limit changes in surface temperature (eg cloudiness, ice cover), yet the underlying response of the

. . . speeding up this pace of change . . .