Science Higher Education in 2015 and beyond

Response from London Metropolitan University

1. London Metropolitan University is pleased to respond to the Royal Society's attempt to take a broad and strategic view of science, technology and mathematics (STM). The constituent parts of what is now London Metropolitan (previously London Guildhall University and University of North London) have, over the past 10 years, considered their position with respect to these subjects as has the new University which was created by a merger exactly 4 years ago. In contrast to an unfortunately large number of universities, the University has made strategic decisions resulting in significant investment in support of STM subjects. These have included a clear commitment to the future and investment in, *inter alia,* an eight storey Technology Tower and a new £28M Science Centre (opening in September 2006).

2. While the University recruits a large number of internationally and from across the UK, it will be evident to the Society's working group that our many local students are recruited from among the most deprived Boroughs in the UK (or Europe). We believe that our commitment to STM under such circumstances is particularly relevant to the real widening participation agenda, for which, perhaps, we are not always fully recognised or financially rewarded.

3. Our comments on the questions posed follow but we would wish to highlight:

   - that an STM higher education produces rounded, employable problem solvers
   - that it essential that the availability of STM undergraduate and postgraduate degrees is not wholly dictated by potentially fickle student demand
   - the need for the pre-HE education system to prepare better qualified entrants to HEIs
   - the importance of ensuring the presence of a diversity of universities, properly funded for teaching and research to deliver STM subjects to the widest possible clientele.

4. *(a) The nature of the benefits to a student that accrue from studying an STM subject at HE level, whatever their future occupation*

   Put simply the major benefits include high levels of numeracy, analytical and problem-solving skills and general employability. Such skills are likely to be even more significant in 2015 and beyond as the knowledge economy develops further. It is also likely that, at that time, STM disciplinary knowledge and skills will be in even greater demand. Evidence of the increased employability of STM graduates is clear from studies showing higher earning power compared with most other disciplines.

   (b) The demand for STM graduates from the economy and wider society, and how this demand is changing

STM graduates are in demand in a range of STM related and non-related employment. However, where the STM discipline is important, graduates do not always have the expertise sought by employers. This is sometimes because course content has not been appropriate, but often because students do not choose to study the right courses. A simple example is in computer science where students have often opted for courses emphasising project management rather than the more useful computer-based or applications skills because they believe the course content will give them access to a range of jobs, not merely in the computing and allied industries.

We have a particular concern that allowing a supply of places in HE to be market-led by student demand is very unlikely to give the UK the STM skills it will need post-2015.

(c) The quantity of those graduating at all levels of the higher education system and the quality, depth and breadth of their educational training experiences

This question relates to (f) below.

We trust that this issue will not be used to question the quality of the increased numbers now graduating compared with the 1960s or 1970s. All the evidence suggests that a higher proportion of the workforce with degrees creates a higher earning and faster developing economy (e.g. Singapore where the age participation rate is *ca* 60%; in London and the South East, where the proportion of those with graduate or postgraduate qualifications is the highest in the UK).

It is well known that the percentages (and actual numbers) of students who study STM subjects in HE in the UK is high relative to a number of developed countries. However, there must be concern that too few are choosing a career in school teaching in STM subjects or furthering their research skills in completing a doctorate. (The latter point is illustrated by the fact that in most STM subjects 40 to 60% of those on doctoral programmes are now non-UK students).

(d) The length of time HE studies should take, and how that time should be broken down (with reference to the Bologna proposals to standardise the structure of HE across Europe)

The attraction of completing a doctorate is already relatively low and there must be some concern as to whether any extension of study would make research in STM even more unpopular. However, we would strongly urge DfES to finally “come off the fence” and work towards an agreement over the Bologna principles. We are, however, unconvinced that for STM subjects the appropriate normal full-time route to a PhD should be 3B + 1M + 3D. If 7 years (total) is to be norm we would prefer the doctorate to be 4 years with staged incorporation of relevant subject- and skills-based components.

(e) The current discipline boundaries, and whether a general science first degree option could be appropriate.

Whatever the arguments for combined science degrees, we do not believe that they will have sufficient popularity with students to be viable. HEIs are continually showing themselves capable of developing offering courses that have interdisciplinary objectives.

(f) The changes to the skills, knowledge and experience of those entering the HE system and how the HE system can accommodate such changes

The pre-HE educational system has failed for many years to deliver individuals with adequate skills and knowledge. Deficiencies in English and fundamental mathematics cannot any longer be fully compensated during a Bachelors degree. Teaching and assessment methods for GCSE and A level are shallow and require too little skill development and have far too little emphasis on learning and knowing *facts*.

It is possible that some of the most recent Government initiatives will produce positive outcomes but this will depend on the momentum being maintained and, crucially, on the availability of *better, well qualified and confident* teachers of mathematics and the individual sciences.

There is already clear evidence that the vast majority of schools that teach the separate science curricula at GCSE are in the private sector. This needs to be considered in the light of other evidence which shows an unlevel field on which those who begin in an under-privileged position continue to receive less favourable opportunities. We would cite one example of this related to the research environment available disproportionately to students from state and independent schools.

If one takes as a proxy for research funding the ranking generated by the Times Higher Educational Supplement from the 2001 Research Assessment Exercise, the "top 10" and "bottom 10" universities show the following characteristics:

	% of students from independent schools	*Students from social class IIIM, IV, V*
"Top 10"	*32%*	*14%*
"Bottom 10"	*15%*	*34%*

All the lower 10 are post-1992 universities, the upper 10 are all pre-1992. If there is to be any science teaching in the post-1992 universities it is essential that there is adequate funding for research so that those from social classes IIIM, IV and V, already often disadvantaged before reaching university are not further disadvantaged by being taught in a higher education wasteland devoid of staff able to challenge and stimulate them and in an atmosphere lacking in research, be it basic or applied.

It will follow from this that London Metropolitan University *does not accept the concept of a teaching-only science department.*

(g) The need to allow students to be flexible in their choices of occupation as they gain their qualifications and afterwards

It is not clear whether we have understood this issue. In a democracy it is essential that individuals are free to pursue whatever career (or non-career) they wish.

(h) The increasing number of students who choose to study later in their lives and/or part-time, and/or have geographic limitations on where they can study

London Metropolitan University has had experience of dealing with the full range of students for many decades. We do not see this as a problem but an opportunity and one which we have willingly addressed. We are convinced that if a local university does not offer individual STM subjects, pupils in local schools and colleges do not believe such subjects to be important.

Decisions made by individual universities about STM subjects have reduced their availability in a way which has not been the case for subjects like business, arts, and humanities, social sciences, etc. One example can be used to illustrate this point.

> *In 1996 the Royal Society of Chemistry published a list of courses accredited for its Graduateship or Licentiateship (Accredited Courses, The Royal Society of Chemistry, August 1996). Such accreditation required the submission of significant paperwork and explanatory text, a task not to be entered into lightly. If one takes the 56 English universities listed in this document as having an accredited "Chemistry"[*] honours degree the following facts emerge.*
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> *For the 21 post-1992 universities, 13 (61%) did not offer a Chemistry degree in UCAS for 2005 entry. For those not entered in UoA 18, 6 out of 8 (75%) no longer offer Chemistry, for those who received a Grade 1 the figure is 4 out of 6 (67%), for Grade 2, 2 out of 6 (33%). The one department achieving at 3b has also stopped offering Chemistry.*
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> *For the pre-1992 universities the percentage no longer offering Chemistry in 2005 were[+]*

Grade 2:	*100% (2 out of 2)*
Grade 3b:	*75% (3 out of 4)*
Grade 3a:	*29% (2 out of 7)*
Grade 4 and above:	*5% (1, Exeter, out of 20; note that King's obtained 3a in 1996)*

> *Note that two universities chose not to enter their chemists under UoA 18; one of those still offers Chemistry the other does not.*
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> *The overall reduction in the percentage of universities offering Chemistry is quite different for the two groups of universities: for post-1992 61% (13 out of 21) no longer offer the subject, for pre-1992 the figure is 26% (9 out of 35).*

It is essential that funding of STM subjects ensures a diversity of institutions, appropriately spread in geographic terms.

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[*] "Chemistry" is used to describe an essentially single subject degree in the subject which may be titled Chemistry, Applied Chemistry or possibly Chemical Sciences. It deliberately excludes e.g. Environmental Chemistry, Chemistry and Forensic Science, etc.

[+] Note that for the purpose of the calculations Manchester/UMIST have been combined.

(i) The financial impact upon students who undertake HE study

A very careful analysis needs to be carried out on the effect of student fees and debt. In the meantime we await with some concern the possible effect on those least able to face up to future debt.

(j)&(k) The impact, on the UK, of international flows of students and STM professionals. The developments in HE and economic policy inside and outside the UK and how the HE system can accommodate these changes

The EC has made clear that a very large number of additional researchers will be needed in Europe before 2015. Most European countries, including the UK, appear to expect to recruit large numbers of undergraduate students, research students and STM professionals from developing countries. Canada, the US and Australia and others also expect to achieve the required numbers of STM professionals by a similar process. Success for all of these countries must be questionable since they will all compete for the same pool of talent. It is essential that the UK ensures that it relies on the development of its own STM professionals rather than assume success in what could be a highly competitive and expensive free-for-all. The alternative could well be that such STM work that should be occurring in the UK beyond 2015will be funded more cheaply *in situ* in developing countries.