

“Increasing Human Resources for Science & Technology”

A submission from the Royal Society of Chemistry to the High Level Group.

The Royal Society of Chemistry (RSC) is the largest learned & professional organisation for chemical scientists in Europe comprising 37,000 members in the UK and 3,000 elsewhere in Europe.

The RSC provides the secretariat to the Federation of European Chemical Sciences (FECS) and supports the Alliance for Chemical Sciences & Technologies in Europe. A report from AllChemE is attached [AllChemE Activities](#).

Increasing the proportion of European GDP invested in research is essential for future prosperity. Achieving this goal is critically dependent upon increasing the numbers of well qualified scientists and the RSC is devoting a large proportion of its resources to support this aim. The RSC welcomes the establishment of the Group and hopes to have the opportunity to contribute further to its work.

The RSC maintains a comprehensive set of data on the output of the UK education system at the schools level and of chemists from universities [Resource Descriptions - Statistics of chemistry education](#). The proportion of school leavers qualified to study chemistry at university has remained roughly constant at about 50,000 for an extended period of time. The number of students entering university to study chemistry reached a peak of 4,100 in 1996 and has gradually declined over the past 7 years by about 22%. Output is, however, still higher than through most of the 1970s and 1980s.

The supply of qualified students leaving school is more than sufficient to support a substantial increase in the production of qualified scientists.

Measures to increase the proportion of qualified school leavers choosing to study chemistry (or other sciences) need to focus upon the attractiveness of the sciences as subjects for further study and of careers in the sciences. The RSC made a major input into the Roberts Review <http://www.rsc.org/lap/polacts/scientistsupply.htm> and commissioned its own study <http://www.rsc.org/lap/diversity.htm>. There have been considerable, and necessary, efforts to improve curricula and the quality of teaching in schools, and much still remains to be done. However, there also needs to be commensurate efforts at the university level to improve the attractiveness and marketing of courses. This needs to be complemented by actions by employers to ensure that attractive career pathways are available.

The range of subjects available for study in UK universities has increased greatly in the last decade as has the awareness of (seemingly) attractive associated career opportunities. Chemistry and the other sciences need to be seen to offer better opportunities.

It is in this context that the RSC offers the following comments on the issues highlighted by the Group:

- 1. Implementation of policy measures aimed at the employment of researchers and science and technology professionals; general trends in employment and qualifications in Europe.**

In the UK there has been a significant increase in the number of university employed post-doctoral workers on short-term contracts over the last 20 years. Whilst post-doctoral work was once seen as part of the apprenticeship for an academic position, the large numbers of people not employed in these positions mean that only a small proportion will find academic posts. The value of such positions to the careers of research scientists needs addressing.

The RSC in its submission to the House of Commons inquiry into the employment of short-term contract workers in Universities, supported measures to make training available to this group of workers to enable them to plan their careers. The RSC also supported the principles laid out in the "Concordat". For further details see RSC Submission to the House of Commons Science and Technology Committee's inquiry into short-term research contracts in science and engineering <http://www.rsc.org/pdf/lap/stcresearchcontracts.pdf>

2. Barriers to mobility within the research and science professions; professional status of researchers and science and technology professionals; sustainable recruitment.

Relatively few chemists occupy positions regulated by law so that formal barriers to mobility within the EU are not a significant issue. However, national barriers to funding of research students exist and restrict mobility. Lack of understanding of the value of education and qualifications obtained in other member states can still be a barrier. Over the long term, full implementation of the Bologna process should help, but this requires a greater political effort than is currently the case.

In respect of current systems of higher education, the FECS has produced schedules of equivalences of qualifications as an aid to recognition and mobility [FECS Category-A Schedule of Qualifications](#). A European Chemist designation (EurChem) has been developed and the RSC provides the secretariat to the Registration Board <http://www.rsc.org/members/eurchem.htm>. The EurChem is derived from the well established Chartered Chemist (CChem) designation of the RSC which has widespread international recognition.

3. Measures aimed at increasing the attractiveness of Europe for science students as well as for scientists and engineers from the rest of the world.

The level of overseas fees in the UK does make it attractive for universities to recruit overseas students (from outside the EU) but by the same token the high level of fees does mean that students may look outside the UK for cheaper alternatives. Recruitment of talented students from across the globe benefits the EU as these individuals may contribute to the EU's research effort, and may well maintain their research contacts when they return to their home countries, again potentially benefiting the EU.

The current unpopularity of undergraduate science programmes means that in order to meet the target of 1.2 million additional research scientists by 2010, it is likely that the EU will need to recruit scientists from outside the EU. Countries like India and China do have large number of talented scientists and EU need to be prepared to allow such appropriately qualified people to work in Europe.

4. National, regional, cultural and gender issues as well as the need to foster enhanced social cohesion and to promote integration of minority communities across Europe.

Women make up nearly half of the student population studying chemistry in universities at undergraduate level and comprise half of the younger (under 30 years of age) membership of the RSC.

Retention of women in academic teaching and research in universities is a major problem in the UK.

The RSC has carried out two studies into the position of women in academic chemistry in recognition that, within the UK, the percentage of female chemistry professors is very low (currently 2%) yet nearly 50% of undergraduate chemists are female. The first study looked at factors affecting career choices of graduate chemists <http://www.rsc.org/lap/polacts/factors.htm>. This study found that men and women were affected differently by issues such as health and safety, and reported that women often found the “macho” atmosphere in some chemistry university departments to be off-putting. In the follow-up study, good practise in the “Recruitment and Retention of Women in Academic Chemistry” was identified <http://www.rsc.org/lap/polacts/womeninacademia.htm>. Interestingly this study found that the “best” departments had family friendly policies aimed at both men and women. These issues are therefore of management not of science. The RSC is now engaged in joint work with the Athena Project <http://www.etechb.co.uk/campaigns/athena.asp> to develop a Good Practice Guide for University Chemistry Departments.

The RSC is also currently scoping a small study jointly with the Institute of Physics to look at ethnicity issues in chemistry and physics.

5. The development of popular ideas about science; general perceptions; the role of the media; the position of science in society.

The RSC has analysed studies carried out in the UK on the public perception of science and of scientists <http://www.chemsoc.org/networks/ncc/allabout.htm>. The public is generally pro-science and scientists but concerned over the pace of change and wants scientists to engage more closely with them on decisions involving science.

There are misconceptions amongst scientists of the public's perception of science and of the role of the media in science.

6. The role of campaigns, initiatives, organisation and actors or organisations aimed at raising awareness and promoting science (science centres and museums); systems of informal education.

The RSC has carried out a controlled experiment on trying to affect the image of chemistry through a sustained campaign in a UK city with a population of 100,000. Whilst short term interest was heightened, follow up evaluation showed that it is difficult to bring about long term change in the adult population through a campaign. A detailed evaluation is available.

The RSC therefore devotes most of its efforts towards longer term goals through the education system in schools.

A study, "Science and the public – Learning for the Future", carried out by the RSC <http://www.chemsoc.org/networks/learnnet/science-public.htm> informs our subsequent work in support of schools and in relation to career choice (points 7 & 8 below).

7. Science teaching in schools; the appropriateness of curricula (content, context, creativity); the teaching environment; support measures and training, mentorship and ambassador schemes; links between schools and science professionals; evolution and objectives of science education policies.

Science and in particular chemistry curricula in schools require modernising to reflect contemporary science and the interaction of science with society <http://www.rsc.org/pdf/education/changingworld.pdf> The teaching and learning environment requires improvement so that both students and teachers have access to modern laboratories and equipment. Science often lags behind other curriculum areas in this respect.

The RSC spends €1.5m pa in supporting chemistry education in schools. It has innovative programmes to provide teachers with study tours in industry, both at home and elsewhere in the EU, and a national programme of chemistry at work events for students. The RSC supports modernisation of curricula through publication of curriculum resource materials ([LearnNet](#)) and provision of courses for teachers. Programmes are described in [RSC Education Department - Schools and Colleges Services](#) and are based on rigorous studies of needs and are evaluated for effectiveness.

The RSC publishes detailed guidance on how to run events at the schools level. The RSC can justly claim to be a European and world leader in this field.

8. Young people's knowledge of careers in sciences; factors that influence choice; level of support and career guidance; access to and knowledge (and perceptions) of role models.

Over the past 15 years the RSC has built up evidence of factors affecting career choice and of those initiatives that have a positive impact on choice (www.). It has an extensive programme of careers education and of publications for young people ([Learnnet](#)) and has produced a guide to scientists advising young people at careers events.

This is another area in which RSC is acknowledged to be a leader.

9. The role that science courses at university level play in preparing assimilation into science careers and research, and in contributing towards citizenship and broadening individual perspectives and aspirations.

The RSC commissioned a report ([Resource Descriptions - Change and diversity](#)) on the requirements for employment.

The RSC seeks to ensure courses in chemistry meet the needs for subsequent professional practice through a system of accreditation. This requires, amongst other features, a substantial research oriented project.

Broader professional skills are encouraged and recorded through an undergraduate skills record <http://www.rsc.org/lap/educatio/ugskills.htm> for students. For teachers in higher education, the RSC publishes a journal, "University Chemistry Education" <http://www.rsc.org/uchemed/uchemed.htm> to provide a platform for university teachers interested in the development of pedagogy. The RSC also works closely with the UK Sector Skills Councils and the Learning and Teaching Support Network.

10. Support to research students in terms of: active supervision; mentoring; exposure to the science community; exposure to job opportunities.

The RSC publishes guidelines on the conduct of PhD programmes, including broadening students' outlook and supervision <http://www.rsc.org/lap/polacts/phd.htm>. Complementary to the undergraduate level, the RSC produces a postgraduate skills record which is finding increasing acceptance by employers of successful doctoral students.

PhD students have access to career oriented short courses in the UK and the RSC runs a number of industry study tours for PhD students, including some in collaboration with the Gesellschaft Deutscher Chemiker.

Once in employment the RSC's qualifications structure and mentoring schemes provide further support and guidance.

Conclusion

The UK shares many of the problems identified as affecting Europe as a whole. However, some have been mitigated through the programmes described above to the extent that the UK still has a vigorous research based chemical industry, a growing SME sector, and despite some reductions, an adequate supply of science graduates to meet current national needs.

But if the UK is to contribute to the required expansion it will need to build upon these programmes and do so with others on a pan-european basis.

A D Ashmore
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