CaSE News

Campaign for Science & Engineering in the UK

The Quarterly Update for CaSE Members

Number 57 October 2008

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Science Minister at the Cabinet Table

The Prime Minister has given a positive signal about his commitment to science by significantly upgrading the position of Science Minister, having appointed Lord Drayson to the post. Lord Drayson will attend Cabinet, sit on the newly formed National Economic Council and chair the Cabinet Committee for Science and Innovation. The move gives Lord Drayson the opportunity to put science at the heart of decision-making in Government.

Gordon Brown appointed Lord Drayson as the new Science Minister in the Department for Innovation Universities and Skills (DIUS) during his October reshuffle. He replaces Ian Pearson MP who is now a Minister of State at HM Treasury and a Parliamentary Under Secretary of State for the Department for Business, Enterprise and Regulatory Reform. Hopefully Ian Pearson will take forward his understanding and interest in science and engineering into these new roles. Ian Pearson was Science Minister for 14 months, taking over from Malcolm Wicks MP who was in position for just 8 months, so it would be good to achieve some stability in the future.

Lord Drayson returns to Government after a stint as a racing car driver in the US. He was previously a minister in the Department of Defence responsible for procurement. Lord Drayson has a PhD in robotics from Aston University and was a successful biotechnology entrepreneur before being appointed a Labour Peer in 2004.

CaSE has long argued that the Science Minister should be at the Cabinet table. Lord Drayson will be one of a select few of non-Secretary of States able to make the case for their portfolio at the highest level of Government. Other ministers who attend the Cabinet are the Chief Whip, Cabinet Office, Housing, Employment and Africa, Asia and UN.

The National Economic Council is a new body formed to give a fresh approach to coordinating economic policies across Government. The Council was created in response to the current economic instability and will meet frequently. It will also examine "how to equip the country for the future by making the right investments in education, skills, science and infrastructure."

It is vital that during these difficult economic times, the UK continues to increase its investment in science and engineering skills and research for the future. It is reassuring that the Science Minister will be able to directly input into such economic planning.

Lord Drayson will also chair the Cabinet Committee for Science and Innovation which aims to ensure integration across Transport, Defence, Health and the whole of Government.

Besides attending the high-level meetings in Government, Lord Drayson's portfolio will include taking forward the Innovation Nation White Paper and developing the Science and Society strategy. Although both of these policy papers provide an important component of the Government's science policy the big issue will be how it progresses the 10 year Science and Innovation Investment Framework. It is critical that Lord Drayson argues the case for following through on commitments made in the 10 year framework, such as the sustained increase in the science budget and achieving the ambitious target of 2.5% of GDP spend on R&D.

Lord Drayson's education and career have been in science and technology, and his racing of a bio-ethanol-fuelled car must surely reflect a passion for engineering and an interest in new and green technologies; he is well placed to champion science and engineering. Lord Drayson himself enthusiastically declared that it was his "absolute dream job". Some areas, like science education, require action by other departments so sitting on the high-level government committees will enable him to argue for this. CaSE looks forward to working with Lord Drayson to make sure that science and engineering are a priority across Government. We will also work with rest of the DIUS ministerial team on issues relevant to CaSE.

John Denham MP remains the Secretary of State for DIUS and Bill Rammell has been replaced by David Lammy as Minister for Higher Education. Sion Simon MP and Lord Tony Young join DIUS as Parliamentary Under-Secretaries of State. Their portfolios had not been announced when CaSE News went to press.

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The next issue will be published in December. If you are interested in contributing, please contact the Editor at the CaSE office by November 12th.

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CaSE Opinion Forum

CaSE is organising its next Opinion Forum on the Impact of Publicly Funded Research. The Institute of Physics and IBM have kindly agreed to sponsor the meeting, which will be held on *12th January 2009* at IBM, South Bank, London. CaSE Opinion Forums bring our organisational members together with invited experts to discuss a topical policy issue.

Increasing the impact of the research base has been prioritised within the Government's allocation of funding for science and engineering and there have been various reports and activities aimed at driving up the impact of universities and public sector laboratories. This Opinion Forum will provide an opportunity to discuss recent policy developments and consider appropriate ways forward. Presentations that examine the issues from academic, industrial and policy perspectives will be followed by breakout groups considering how to measure impact, incentive structures and funding and the culture of knowledge exchange. See page 6 for more discussion on Research Council UK's impact expectations.

All of CaSE's organisational members will receive an invitation in due course, but for now please *save the date*.

CaSE meets its roots

CaSE's director, Nick Dusic, met with two of the founding members of Save British Science (SBS), Dr John Mulvey and Professor Denis Noble, whilst visiting Oxford in September. They discussed current issues in science policy and how they related to Save British Science's work in the early years. John and Denis also talked to Nick about the process they went through to secure a meeting with Tony Blair when he was Leader of the Opposition and its importance in setting the tone for the Labour Government's science policies.

Save British Science was founded in 1986. Over the last twenty years there have been numerous letters to politicians, responses to parliamentary inquiries, media clippings and policy reports. Nick, John and Denis discussed the importance of archiving this material as it will be of interest to science policy scholars now and in the future. They are looking into options to create a SBS/CaSE archive.

Science Diplomas

CaSE is a part of the Science Community Working Group of the Science Diploma Development Partnership (SDDP) and has attended one meeting in September as well as a workshop in July. CaSE objected to the blatantly political way in which the Science Diploma was announced with next to no consultation of the relevant stake-holders. Nevertheless, the goals of the diploma are surely good ones: to provide a broad based understanding of science with a core of mathematics, to engage students by teaching in relevant contexts, and to minimise the division between vocational and academic qualifications.

There are a number of issues that need to be dealt with for the Diploma to be successful. There is a very tight timetable for planning the Diploma, which will inevitably mean an inadequate piloting phase. The organisational complexity of the qualifications make it hard to administer as well as be understood by students, teachers, parents, universities, and employers. There needs to be clarity about its status for university entrance. The addition of the diploma could strain already over-stretched science and mathematics teachers if they are not better resourced. Finally, there needs to be engagement with local employers to provide work placements early on, although this may become increasingly difficult given the current economic climate. CaSE is working with other organisations to ensure that these concerns are dealt with so the Science Diploma becomes a valuable qualification.

The current phase of consultation asks among other things, what the vision and purpose of the Diploma is and what will determine its success. There is an interesting consideration of whether to use biology, chemistry and physics as a way to organise scientific skills and knowledge, or if there is a better alternative. Also, the science skills that form the core of the diploma are being identified.

If you have specific comments on the Science Diploma, please contact Hilary Leevers at CaSE or participate in the process directly by visiting http://www.sciencediploma.co.uk/.

CaSE meetings

CaSE's director and assistant director, Nick Dusic and Dr Hilary Leevers, had a series of meetings in September with officials and advisers in the Prime Minister's Office, HM Treasury, Department for Innovation, Universities and Skills (DIUS) and Department for Children, Schools and Families (DCSF). They also met with the then Science Minister, Ian Pearson MP. Through these meetings CaSE brought both the concerns of its members to the attention of policymakers, and also constructive proposals on the UK's investment in research and increasing the number of scientists and engineers.

We talked about overall science policy, including the recent Innovation White Paper and the forthcoming Science and Society Strategy. CaSE was keen to get across the fact that although both of these proposals covered aspects of science policy, there was not a clear science policy statement at the moment other than the Ten-Year Science and Innovation Investment Framework. We argued that it was critical that the Government saw through its commitments made in the framework.

We also discussed the importance of the Haldane Principle and the implications of the last Science Budget Allocations.

We engaged in constructive dialogue about our forthcoming Opinion Forum on the impact of publicly-funded research (see opposite). Treasury, Number 10 and DIUS agreed that it would be really useful to bring policymakers and the science and engineering community together to discuss this important area. There was discussion about current work underway within Government on this issue and the importance of considering it in advance of the next Comprehensive Spending Review.

One concern that also came out of the meetings is the need for government departmental R&D budgets to be better protected from over-spends in other areas. This was one of the recommendations of the Sainsbury Review. There are current discussions underway within Government about how to develop a 'robust mechanism', which CaSE will be feeding into.

Another theme running through our discussions was the importance of increasing the number of people studying science and engineering. We made it very clear that this was a priority for all of our members. CaSE has developed its work in this area by looking at STEM education, diversity, and immigration.

There has been great interest in our proposals for *Higher UCAS Points for STEM Subjects* and the *Diversity Bursary Scheme* (see CaSE News 56 or website). We are continuing to develop these ideas and will work with all parties to move them forward. We are including these proposals in our response to the Science and Society strategy, which looks at both STEM skills and diversity. We have also proposed the creation of a resource centre for disabled scientists and engineers. The resource centre could help to share lessons learned in fitting out laboratories and providing other support. This was one of the recommendations that came out of our policy report *Making Science and Engineering Accessible to All*.

CaSE also discussed immigration policy issues and its impact on the UK being a world leader in science and engineering. We are drawing up our policy report on the issue at the moment.

With the DCSF, we discussed our proposals as well as the 'entitlement' for students to study three separate sciences at GCSE (see page 7). CaSE is pushing for this entitlement to become a reality on the ground. At the moment it is non-statutory. CaSE will examine how the first year goes and will push for it to become a statutory entitlement if real progress is not made.

CaSE will continue to constructively engage with officials, advisers and politicians to move forward policies that will improve the state of science and engineering in the UK. CaSE documents, briefings and old copies of the newsletter are available to download at *http://www.sciencecampaign.org.uk/documents/index.htm* or contact the CaSE office for hard copies.

Nick Dusic and Hilary Leevers before their meeting at Number 10

Change of Address and Email Addresses Please!

Please do not forget to let the CaSE office know if you change your address.

In addition, we would greatly appreciate it if those members who have not provided us with an email address could do so, then we will be able to contact you if the postal address becomes out of date.

You can also choose to read more about CaSE's recent activities and also about what we are planning, by signing up for the **CaSE monthly email update** by emailing nickh@sciencecampaign.org.uk.

UK Space Industry

New figures for growth in the space industry were announced by the then Science Minister, Ian Pearson, at the Annual Astronautical Congress, held this year in Glasgow. This is the first time the congress has been held in the UK since 1987.

The figures were compiled in a new report by the British National Space Centre entitled 'Size and Health of the UK Space Industry 2008'. The report found that the UK space industry sector grew by nearly 8% in 2006/07 with an overall turnover of £5.8 billion; commercial services continue to dominant the sector (85%, worth £5 billion). Total employment in the UK space industry now stands at nearly 19,000, with over 1,600 new jobs created in 2006/07. Of the total, 60% of staff hold a first degree and one third of these also have a second degree. More than 5,800 jobs in the systems sector are amongst the most highly skilled in the UK economy. As part of the report, companies were asked where they felt they were experiencing skill shortages. The responses focused on engineering disciplines (electrical, mechanical and systems) followed by graduates with numerate degrees. Employment in the space sector remains concentrated in the South, with over half of companies in London and the South East.

Encouragingly, 39 new companies entered the survey this year, many of them formed within the past two years, reflecting the dynamic nature of the business. Commenting on the sector, Ian Pearson stated: "The space industry makes a significant contribution to the UK economy. By its very nature it's highly innovative and is one of the highest value adding sectors. It will play a significant part in driving forward the UK's future knowledge economy."

During the congress, the Science and Technology Funding Council (STFC) announced Canadian-based MacDonald Dettwiler and Associates Ltd (MDA) as the first major commercial space company to establish operation on the Harwell Science and Innovation Campus. The campus, a 50:50 joint venture comprising both public and private sector partners, is part of the Government's ten-year UK Science and Innovation Investment Framework towards increasing the economic impact of public investment is science and technology. Professor Keith Mason, Chief Executive of STFC said he hoped it would, "encourage others operating in the space field to follow MDA's lead in building on this rapidly expanding and exciting centre for innovation."

Manufacturing Strategy Report

This September, the Government unveiled a new strategy report - 'New Challenges, New Opportunities' - to help UK firms take advantage of changing global trends in manufacturing.

Developed jointly by the Department for Business Enterprise and Regulatory Reform and the Department for Innovation, Universities and Skills, in partnership with industry, the strategy stresses the manufacturing sector as a key part of a mixed and balanced UK economy in the future. UK manufacturing provides £1.5 billion per year to the economy, accounts for half of total UK exports, and for 75% of total UK business R&D.

The strategy identifies five major dynamics which are reshaping global manufacturing, and outlines the measures which Government is taking in helping the UK compete. These trends include: the complexity of global value chains, the accelerated pace of technological exploitation, the growing importance of investment in intangibles, increased investment in people and skills, and the need to move to a low carbon economy.

The strategy emphasizes the need for Government to provide incentives to invest in broad-based science and technology research, ensuring that the markets act as powerful drivers of technological innovation. The Annual Innovation Report, to be published in October 2008 will showcase a wide range of government departmental activities that promote innovation and describe each department's plans to do more.

The report estimates the need for an additional 324,000 scientists and engineers by 2014, as well as more skills in teamwork, leadership and management and a more generic set of flexible cross-disciplinary skills. The UK Commission for Employment and Skills will target the manufacturing sector as a first pilot for relevant proposals to simplify the skills system, including building the 'Train to Gain' project into a more integrated service offering a range of options for employers, and will report to Government in the autumn. The Government will continue to promote work on manufacturing and high-technology via the University Enterprise Networks and Regional Development Agencies, particularly in the North West and South East.

The strategy also highlights the fact that fewer than half of school leavers and graduates with engineering skills take up careers in manufacturing. In response, the Government has set out its 'Manufacturing the Future' campaign, to promote manufacturing careers to school students. The campaign will build on the new engineering diploma for 14-19 year olds, the forthcoming manufacturing and product design diploma, and the cross-government project currently looking at labour market needs for STEM skills.

CaSE will monitor these proposals, and continue to hold constructive dialogue with government, representatives from the manufacturing industry and other interested parties.

Societies Challenges are Sciences Challenges

A report published by the Trade Union Council (TUC) argues that science, technology, engineering and mathematics (STEM) have an important role to play in wider society. The report entitled 'Hybrid Cars and Shooting Stars' explores the links between science and democracy and how advances in science benefit us all, be it through combating illness and disease or responding to climate change.

The UK is a centre of scientific excellence but funding cuts, lack of equality and diversity and workload pressures threaten this status. As well as properly paying our scientists, their social contribution should be highlighted and celebrated. Achieving a more diverse workforce will alleviate shortages and bring its own gains through widening approaches, and also have a knock on effect down the career ladder, encouraging more students to progress further in STEM subjects. These are issues that CaSE continues to campaign strongly for.

The TUC congress used the report to call on their General Council to lobby Government. They wanted greater cross-departmental consistency on policies and decisions that affect investment in skills, recognition of the intrinsic value of research by halting cost-driven proposals to cut research programmes, and work with unions to encourage uptake of STEM in higher education and improve STEM careers. The TUC is well placed to voice its opinion – thousands of trade unionists work in research and teaching professions – and should be consulted on the future of UK science. The challenges facing our society also challenge the science community and are relevant to all.

Departmental Chief Scientific Advisors

CaSE has long been an advocate for improving the system of science and technical advice within Government. To this end, CaSE has championed the appointment of a Chief Scientific Advisor (CSA) for every government department, building upon the Government's recommendation in 2002 that all departments with an 'appreciable' scientific element should appoint such an advisor.

While some departments, particularly the Ministry of Defence, have had such a post for decades, other departments, such as the Department for Environment, Farming and Rural Affairs (DEFRA), have since been quick to create the post of CSA and set up an internal scientific advisory council to monitor the quality of advice on offer.

However, other departments have been less successful. The Department for Culture, Media and Sport (DCMS) has been noticeably slow at implementing the Government's strategy and appoint an internal CSA. A 2004 report by the Office of Science and Technology (OST) found that there was "no co-ordinated strategic approach in DCMS to the use of science" and recommended that the department should appoint a senior CSA. In response, the department agreed with the report's findings, insisting that it "hoped to advertise the position soon", although no appointment was made. A report by the House of Lords Science and Technology Committee in 2006 supported the OST's findings, claiming that "DCMS does not currently possess the scientific expertise to act as an intelligent customer of science" and that it should move rapidly in appointing a permanent CSA. A departmental review led by National History Museum Director, Dr Michael Dixon, published in June 2007, recommended that the Department appoints an independent CSA, ideally from the natural sciences.

In September 2008, DCMS announced the appointment of Anita Charlesworth as director of the department's Evidence and Analysis Unit, to take on the function of CSA. The Secretary of State's decision to appoint a former Director of Public Spending at the Treasury and Chief Economist at DCMS, fails to meet the criteria of an independent CSA. As a department with a resource budget of £1.6 billion, and who sponsor major scientific projects and facilities such as the Science Museum, the British Library and the Olympics, CaSE believes it is crucial that DCMS integrate high-quality, independent scientific advice.

CaSE is also concerned by DCMS' lack of definitive time frame for establishing a scientific advisory panel. CaSE believes that each government department should have an internal advisory scientific council, both to assist the work of the CSA and to monitor the quality of advice on offer. While certain departments have successfully appointed high-quality CSAs, their failure to create an advisory council to run in parallel, risks impairing that department's scientific expertise. In October this year, the Government Office for Science review of the Department of Health recommended that an independent scientific council be set up to support the CSA, similar to that already in existence at the Ministry of Defence and DEFRA.

This situation in government has been made worse by the Foreign & Commonwealth Office's decision earlier this year to re-locate its Science and Innovation Network to within DIUS, thereby diminishing the department's in-house scientific expertise. Despite being named as one of the FCO's 10 priorities in its 2006 white paper, science has since fallen off the departmental agenda and currently the FCO "has no plans" to appoint a departmental CSA. At a time of growing competition from countries such as India and China, who see research and development as key to progress, CaSE believes this position to be misguided and have campaigned for a greater role for science in the FCO and a departmental CSA.

The creation of a new Department of Energy and Climate Change gives its Secretary of State, Ed Miliband, a great opportunity to underline the new department's scientific and engineering credentials. The issues and challenges which this new department are facing mean that independent and high-quality scientific advice will be crucial. CaSE has written to Ed Miliband asking him to seize the initiative and advertise immediately for the position of departmental CSA, as well as members of a new Scientific Advisory Council.

CaSE will continue to hold meetings and discussions with individuals from government on the issues raised in this article, and will seek to underline the importance of independent science and engineering advice in policymaking.

Science and Engineering Fast Stream

One of the concerns that our latest membership survey picked up was the lack of scientists and engineers in the civil service. The Civil Service Fast Stream is a training and development programme for graduates who have the potential to reach the Senior Civil Service. There are five schemes, of which the general Fast Stream is the largest and also includes a special scheme for scientists and engineers.

CaSE supports the science and engineering fast steam as a way of getting more individuals with a technical background into the civil service. The problem is that last year there were only 15 people appointed to it. The economics fast stream appointed 101. Out of the 249 successful candidates for the general fast stream, which includes the science and engineering fast stream, only 37 had a STEM related degree. By contrast there were 82 people with a humanities degree.

Increasing the number of people within the civil service with engineering and technical skills needs to become a government priority. Leave aside the fact that many policy issues have a scientific or technical element. Forget that scientists and engineers have strong analytical skills valued in a range of professions. Policymaking requires a range of perspectives being brought to bear on an issue. A historical or economic perspective is important, but so too is a scientific or technical perspective. There needs to be a better balance of skills within the civil service. If government is going to have senior civil servants with a science or engineering background in the future, they need to expand the science and engineering fast stream as matter of urgency.

Societal and Economic Impact

Research Councils UK (RCUK) published its *Expectations for Societal and Economic Impact over the summer*. RCUK argues that in return for giving researchers "considerable flexibility and autonomy" it expects them to show an awareness of the wider environment and context of their research and of its social and ethical implications, taking into account public attitudes. Researchers are encouraged to actively engage with the public, with results published widely. They should also identify potential benefits and beneficiaries from the outset, and throughout the project. It is the responsibility of the researchers to "exploit results where appropriate, in order to secure social and economic return to the UK" and help all their staff develop skills for their future careers.

Increasing the economic impact of the research base is a Government priority. This document came out of ongoing discussions within the Research Councils on how to show DIUS and Treasury that it will make the "step change" that the Government wants to see for its increased investment.

It is not yet clear how the list of expectations will affect things on the ground. Is it an attempt to produce a cultural change within the research community so that it is more outward facing? Is it meant to affect research funding decisions and career advancement? CaSE has started a new project that will engage in this debate to make sure that "impact" is put in context and policy proposals are appropriate.

There have been concerns within the academic community that the increased focus on economic impact could undermine funding for fundamental research if researchers or assessors are expected to predict the impact of the research. The history of science is littered with examples of serendipitous impact, which could not have been predicted at the outset of a research project. If impact is expected to be known at the outset, it will affect the type of research being done in the UK. The Government needs to be aware of the serious repercussions it would have on the UK's standing in science and also its ability to innovate. A lot is asked of researchers, they need to produce internationally excellent research and for it to have an impact on the UK's economy or society. Sometimes this happens and we should applaud it when it does. But it is critical to keep expectations in perspective. Not all research grants awarded will be either newsworthy, commercially exploitable or policy relevant. Some of course will be and when they are, researchers should push forward their results in an appropriate way. Research Councils should give them appropriate support to make it successful (funding, time, support, etc.). However, if a piece of research doesn't have an immediate impact that can be okay. Advances, setbacks, wrong turns all have their place in the scientific endeavour, which can lead to someone else having impact in the future.

CaSE will be holding an Opinion Forum on the Impact of Publicly Funding Research (see page 2) and looks forward to advancing policy discussions in this area before the next Comprehensive Spending Review.

Wakeham Review of UK Physics

The much anticipated Review of UK Physics led by Bill Wakeham, vice-chancellor of the University of Southampton, was published in October. The review was announced following the release of the Science Budget Allocation in December 2007, which shot to the headlines due to £80 million funding shortfall in the allocation for the Science and Technologies Funding Council (STFC). However, the Review was not asked to look at this particular issue. Rather it looked at the how to move the discipline forward in the medium term.

The overall conclusion of the Review was that physics in the UK was in good health, but that it faces a series of challenges. It reasserted a number of ongoing issues that have to be properly addressed, such as strengthening physics education in schools, greater separation between funding for facilities and grants, and better flow between industry and academia. It also made a number of recommendations regarding the STFC's operation.

The Review made a number of good general recommendations that CaSE is keen to see followed through. The Review recommended that data should be collected on the levels of research funding that are comparable to other countries. The Government has agreed that this is a priority. There is aggregate data, which is useful for comparing overall levels of spending, but more detailed information would be helpful in seeing if we are lagging further behind in certain fields.

The Haldane Principle came up in the Review. It recommended that the Haldane Principle needed to be updated for the modern era, something that CaSE has argued for. The Government responded that it has done so through a speech by John Denham, Secretary of State for Department for Innovation, Universities and Skills (DIUS), to the Royal Academy of Engineering. Although this was a good start, there are still issues to be resolved, since there is a large grey area between what is a 'detailed research priority' as decided by researchers and 'over-arching strategy' as decided by Government.

The Review also recommended that the Director General for Science and Research (DGSR) should be advised by a group outside of DIUS, the Royal Society has called for such a group as well. The Government said that in the future the DGSR would formally seek advice from a number of national bodies, presumably the national academies. CaSE agrees that external advice could be advantageous, but a number of issues need to be thought through first. We hope that the Government will consult on this proposal before taking it forward.

The Wakeham Review adds to the Innovation, Universities, Science and Skills Committee inquiry into the last Science Budget Allocations. The new DGSR, Professor Adrian Smith, will need to take both reviews into account in advance of the next Comprehensive Spending Review discussions. It is critical that lessons are learned so that the scientific community has trust in the process next time round.

New GCSE delivery and results

CaSE was delighted to see an increase of about a third in entries into separate science GCSEs, also known as "triple science", this summer - biology was up 35% to 85,521, chemistry up 29% to 76,656 and physics up 29% to 75,383. This was in a year when overall number of GCSE entries decreased 2.7%. Taking triple science increases the likelihood that students continue to study science and do well at it.

Although mathematics GCSE entries decreased, this was probably accounted for by a decreasing cohort, and entries into alternative exams (e.g., the IGCSE). Happily, additional mathematics entries increased by 74% to 17,871 and statistics GCSE entries also increased to 86,224.

The rises in triple science entries may reflect improving student preference; possibly accentuated by the fact that under the new science GCSEs students can take science courses consecutively or in parallel (see Table below). All students must study a core of science (comparable to what was previously known as single science), which they can then boost with additional or additional applied science (comparable to former double science, but now with a more academic or vocational focus), or they can take enough extra units to claim triple science. The new courses were originally intended to run in parallel, but in practice many schools are delivering them consecutively, with students taking the GCSE science at the end of Year 10. It seems possible that children who might previously have committed to double science at the start of Year 10 are instead choosing triple science at the end of it. If a student claims GCSE Science in Year 10 and then triple science in Year 11, their original science GCSE would no longer count.

Unfortunately, the different modes of presentation and the fact that this year some children are still being entered under the old system, make it hard to tease out the percentages taking different subjects, especially as all years are reported together in August. It is also quite clear, from the media coverage and our discussions with other organisations, that not all have fully understood the new system. CaSE is looking forward to the release of more detailed data in mid-October.

It is likely that much of the increase in triple science is because many more schools are now offering it. Only 26% of normal schools entered students into triple science in 2006 and 58% of science specialists. Information obtained from the Department for Children, Schools and Families by CaSE through a Freedom of Information request revealed that over half of (not science-specialist) schools that did not enter students into triple science in 2007 now offer it. On the other hand, a fifth of schools that did not enter students into triple science in 2007 have no plans to offer it now and another fifth remain undecided.

The Government made the following commitments in its *Science and innovation investment framework 2004-2014: next steps*, for September 2008:

- all pupils achieving at least level 6 at Key Stage 3 to be entitled to study triple science GCSE (although, not necessarily in their own schools);
- all specialist science schools to offer triple science at least to all pupils achieving level 6+ at the end of Key Stage 3.

The first statement is a commitment to an entitlement; it is intended to encourage all schools to offer triple science but it is not their statutory duty to do so. CaSE has been contacted by parents who do not understand why their schools are not following the commitment. Please do get in touch if you are in a similar position, or know of those who are, as CaSE is working hard to make sure that all schools offer triple science. The Government has set up a triple science support programme to provide practical advice and support to schools (http://www.triplescience.org.uk/).

The commitment for specialist science schools to offer triple science really should become a reality over the next few years, as schools will not be able to be register or be redesignated as specialised in science, engineering, mathematics or technology if they do not offer triple science from September 2010.

	Year 10 exams	Year 11 exams
Old system		Single science
		Double Science (2 GCSEs)
		Triple Science (3 GCSEs)
New system – consecutive	Science	
	Science	Additional or Additional Applied Science
	Science (doesn't count later)	Triple Science (3 GCSEs)
New system – parallel		Science
		Science & Additional or Additional Applied Science
		Science (unreported)
		Triple Science (3 GCSEs)

Science A levels rise but "market share" static

While numbers of entries increased in all of the science A levels, the overall numbers of entries also increased. Unfortunately, there was not an actual increase in the proportion of entries in any of the sciences. Entries in biology increased by 1,447, chemistry by 1,395 and physics by 630. Just 46 of the 630 additional entries in physics were attributed to females as were 239 out of the 1,395 in chemistry. This is really disappointing given recent efforts to excite girls about science and also given how well they do, outperforming boys in mathematics and all the sciences, particularly in physics.

Mathematics continued its surge in popularity, with a combined increase of 5,700 in mathematics and further mathematics which reflected more students choosing mathematics over other subjects and not just the overall rise in entries.

Overall, 26% of candidates received A grades, compared with 27% in biology, 34% in chemistry, 32% in physics, 44% in mathematics and 58% in further mathematics. This does suggest that there are many more students who could be taking these subjects.

CaSE's Assistant Director, Dr Hilary Leevers, was pleased to explain the issues on BBC News. She also discussed (and defended) CaSE proposals to award more UCAS points for science and mathematics, to encourage more students to study these strategically important subjects.

Lessons from the Scottish Highers

Scottish students also received their results this August, with increased entries in physics highers and fairly stable numbers in biology, chemistry, and mathematics. Numbers for advanced highers were stable in the sciences, with increases in mathematics. What is so striking in the Scottish highers is the similarity in number of entries across the sciences, of around 9,000. In Scotland, teachers can only teach biology, physics and chemistry if they are qualified in those subjects. This surely illustrates the importance of having specialist physics and chemistry teachers in encouraging students to continue with those subjects, something which we have much more difficulty in the rest of the UK.

Inspiring scientists for the future

I can remember being very proud that my picture of a nurse was chosen to adorn my primary classroom, when we had been asked to paint "what we would like to be when we grow up". My own daughter at the same age wanted to be a hairdresser. These are quite typical choices, along with actor, footballer and singer, as the recently-published report *Learning to Love Science: Harnessing children's scientific imagination* confirmed. Children are exposed to these people and careers in their home and schools, through visits to the hairdresser, television programmes, and school topics such as "People who help us".

So, where are the science-related choices? And do these choices change as children move through the education system? All students must study science up to the age of 16, so making A-level choices is the first opportunity to choose or reject science. Over the last 25 years, the proportion of A-level students selecting the physical sciences reduced, while biology remained fairly stable. Due to concern over these declining statistics and shortages in certain professions such as chemical and electrical engineering, there have been many recent studies exploring children's perceptions of science.

One of the main issues raised is students' perception of the science curriculum as being too abstract and theoretical. Although students believe that science is 'useful' and 'important', they don't see it as relevant to their everyday lives. This can be addressed by embedding scientific concepts in 'real-life' contexts - storylines used in the classroom. This approach has been used for many years by the Chemical Industry Education Centre (CIEC), and other organisations involved in curriculum development. An example of this, used in primary schools across the north of England in the *Children Challenging Industry* project, contextualises the concept of filtration. Rather than the 'today, children, we are going to learn about filters' approach, a letter from industry is read to the class. This letter asks children to help solve some filtration problems by carrying out classroom-based investigations, and then to send the results back to the company. Children are very motivated by this approach.

Students cite practical work as one of the most enjoyable aspects of the subject, yet many perceive the curriculum as becoming less and less practical as they move through school. Teachers need to be confident in order to carry out practical work. However, between 1983 and 2007, the percentage of science teacher trainees who were physics specialists fell from 30% to 12%. In addition, 41% of up-to-16 schools and 11% of up-to-18 schools had no physics specialists in 2007. Thus, there are many non-specialists who are likely to lack the confidence for practical work. Despite financial incentives to address teaching shortages, it continues to be a cause for concern.

The emphasis placed on tests has also reduced practical work. As one primary teacher states; *"The biggest issue in primary schools is the amount of content of science we have to get through. Instead of just doing lots of investigations, at the back of your mind you are thinking we have to get this covered otherwise they won't know it for their SATs at the end of year six."* After the disruption caused during the marking of this year's test papers, we will hopefully see such testing reduced

Whilst we want students to enjoy practical work, there are other aspects of science that are equally important. A survey of 9-14 year olds carried out by Shell this year, revealed that students do not perceive science as being a creative pursuit, or one that requires much communication. We have to move children away from this idea that science is a body of knowledge to learn for an exam, to understanding that it is a creative pursuit, involving the formulating of hypotheses, the creation and carrying out of experiments to test their hypotheses, and the analyses of the data generated. They also need to appreciate the importance of communication for generating ideas, solving problems, discussing data, and transferring laboratory work to plant-scale construction and production etc. The recently incorporated *How science works* component of the national science curriculum in secondary schools will hopefully redress these concerns. We would welcome a similar element as part of the new primary curriculum from 2011.

Primary school children should be exposed to the excitement of science, including the many STEM activities around the country, and the opportunities science bring, and this should continue throughout their education. Evidence finds no specific age at which children 'switch off' from science or are 'turned-on' to science-based careers. Children start making decisions at the age of 9 or 10, and this process continues throughout their education and lives, so careers advice should not be left until 14 or older. Introduce children to scientists and engineers in industry and academia when they are 9 or 10, and continue contact through the years. Across the country, primary children engaged in CIEC projects visit scientists in industry to talk to them face-to-face. This is a very memorable experience, and one that raises children's awareness of where science could take them. After all, how do you think my interest switched from nursing to chemical engineering? Yes – visiting chemical engineers at ICI. Need I say more?

The report is available to download from the CIEC website at *http://www.ciec.org.uk/*.

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The M in Stem - Mathematical Sciences in the UK

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Mathematics is the language of science and engineering. It is also the language of business, industry and government. And that isn't to mention the input mathematics has to our cultural lives – whether through a daily sudoku or through a glance at the shapes, both natural and manmade, surrounding us. Even Hollywood has been embracing mathematics in its storylines, with recent movies such as *The Oxford Mysteries* and *21* basing their storylines on mathematicians. Mathematics truly is everywhere.

The mathematics community is proud to be the M in STEM, and the London Mathematical Society (LMS) and the Institute of Mathematics and its Applications (IMA) are delighted to be joining the Campaign for Science and Engineering. CaSE has long been making the case for mathematics both as vital to support its member science and engineering organisations and employers, but also as a subject in its own right with its own issues and concerns.

The LMS and the IMA are the two main UK bodies representing mathematics and supporting its advancement, extension and promotion. The LMS was founded in 1865 and has around 2,500 members who are mainly UK-based academics. The IMA was founded in 1964 and has around 5,000 members, including academics, teachers and mathematicians working in industry and government. The LMS and IMA are in the process of exploring the idea of reorganising themselves into a single society. This proposition is being put forward to members of both organisations and if the consultation is positive a vote on whether to go ahead with a single unified society will be taken in 2009.

Recent years have seen the mathematical sciences community work more closely together. In particular, the LMS and IMA work closely with the Royal Statistical Society. In 2001, the three organisations formed the Council for the Mathematical Sciences (CMS) to present a single and strategic voice to government, policy makers and funders. The CMS is chaired by Sir David Wallace, and speaks on issues in higher education, research, business, industry and the public sector. The CMS recently expanded to include the Operational Research Society and the Edinburgh Mathematical Society. The mathematics teaching bodies similarly have closer links and joint activities.

There are plenty of reasons for the mathematics community – and others who use mathematics – to be cheerful. Our numbers are enjoying a period of healthy growth. Following the introduction of Curriculum 2000, A-level entries plummeted with the number of A-level entries dropping almost 20 per cent, but this year, entries are back to their level before the fall. Further Mathematics is now one of the fastest growing subjects at A-level, largely due to the determined work of the Further Mathematics Network to ensure teaching for the A-level is available throughout the country.

The number of students accepted onto mathematics undergraduate degrees is also growing. In 2007, over 54% more students began their mathematical training than in 2002. This impressive increase is for straight mathematics degrees – in contrast, the downward trend in the overall JACS category of 'mathematics and computer science' is of some concern.

Even so, we can't be complacent about rising interest in mathematics. To fulfil government dreams for a knowledge economy, a mathematically-trained workforce will be necessary. Widening participation in mathematics to ensure women, ethnic minorities and all age groups are represented is vital. And there are still hurdles to overcome in terms of policy, funding and especially image.

At school level, the mathematics community is working to ensure that the introduction of two GCSE awards for mathematics prepares students to go on to A-level and that all schools offer their students the opportunity to sit both.

And there is ongoing concern about the number and quality of mathematics teachers. Government initiatives have successfully encouraged more people to qualify as mathematics teachers, but retention continues to be a serious problem. The recent Ofsted report *Mathematics – understanding the score* concluded that only half of mathematics lessons evaluated were 'good' or 'better' which is not good enough. It also noted that too much teaching concentrated on getting the children through examinations – a factor which may also impact on teacher retention.
In research, a change in emphasis at the Engineering and Physical Sciences Research Council is a major concern. As funding is moved towards large-scale multidisciplinary research programmes, the mathematical sciences programme has seen its budget cut from £18.5 million in 2007/8 to £16 million this year. In previous years, the budget had topped £20 million. However, it should be noted that the EPSRC has maintained the budget for responsive mode funding for mathematics at the 2007/8 level, recognising this is the highest priority for the community.

The CMS has worked closely with HEFCE to ensure that the particular needs of mathematics are accommodated in the proposed Research Excellence Framework. Bibliometric indicators are very problematic for assessing research quality in mathematical sciences, since the timescales for citing mathematical research are often much longer than in the sciences (in fact, anywhere up to 2,000 years!). Fortunately, HEFCE has now announced that the distinction between assessing science and non-science subjects has been removed, allowing all subjects to be assessed according to their needs.

The image of mathematics is still one of the most important and difficult problems the mathematics community needs to overcome. In June, Sir Peter Williams presented his report *Independent Review of Mathematics Teaching in Early Years Settings and Primary Schools*. In it, he laments, "The United Kingdom is still one of the few advanced nations where it is socially acceptable – fashionable, even – to profess an inability to cope with the subject."

Indeed, this was borne out by Professor Celia Hoyles when she appeared on BBC Breakfast News in September to comment on the Ofsted mathematics teaching report. She said that afterwards the presenters turned to each other and laughed, "Well I can't do maths - I don't know what 7 times 7 is!"

The LMS and IMA set up the Mathematics Promotion Unit in 2004 to raise the profile of mathematics with the media, government, policy makers and the public. This has been a useful entry point to the mathematics community for the outside world, particularly press and media, as well as a networking mechanism for the community itself. Changing attitudes will take time, but the signs are positive for mathematics. We look forward to collaborating with CaSE and to meeting other members, particularly those for whom mathematics is key.

Making European Research Work

Luke Georghiou is Professor of Science and Technology Policy and Management, University of Manchester and was a member of CaSE's Executive Committee.

During the past year the European Commission and its Member States have been seeking to re-invigorate the European Research Area (ERA), a concept first put forward eight years ago. Though never clearly defined, ERA described a bundle of measures seen to make Europe's research system more efficient and effective. It was significant in moving beyond the long-running Framework Programme, now in 7th incarnation, to encompass the other 95% of the research system. Achievement to date has been mixed at best – with the headline objective of raising research spending to 3% of GDP by 2010 having little or no effect, hence the re-launch.

Proposals for taking ERA forward appeared in a Green Paper and now form the core of discussions by Europe's research ministers. However, the initial proposals were still largely locked into thinking about how to improve the research system without opening up the wider question of why we want research at the European level. A panel which I chaired was given the task of considering just this – "What is the rationale for ERA?" In simple terms a rationale is a reason for doing something and this was the question that we applied to all activities.

In our report published earlier this year we began with the principle that the core objective should be to maximise the value contributed by research, today and into the future, to Europe's economic, social and environmental goals. The research system cannot be treated in isolation from its critical linkages with innovation, education and the wider thrust of EU policies and aspirations.

Some readers might immediately take issue and argue that high quality research provides its own justification. To this I would reply that there is indeed a compelling case for investigator-driven research allocated by peer review to the best individuals and teams. Europe has begun to engage with this through the European Research Council (ERC) and the high quality of the initial response suggests that it deserves a much larger budget. But, in terms of rationale this argument has its limit – the ERC is justified on a "Champions League" argument –that higher competition and prestige will drive quality upwards. This is true but a Champions League cannot exist unless fed by national leagues and few are arguing that national funding schemes should not continue to be the dominant mode. More can be done to improve basic research (for example internationalising peer-review so that the standards of the best can be applied to all) but this misses a key point.

Most of the budget for European research exists because it is seen to contribute to socio-economic goals. Hence any consideration of rationale must engage with whether we are doing this job in the best possible way. If the money were only for basic research there would be a lot less of it. The proposals in the Green Paper were worthy in themselves but were essentially about fixing perceived deficits in the research system. What they did not do was engage with the outcomes of research in a way that would reach out to stakeholders within and outside the system. The alternative we proposed was a switch in thinking from deficit to opportunity by introducing a strong content dimension to ERA.

There is an important opportunity on the horizon in a forthcoming round of reform and new financial framework for the EU budget. This could be used to make a reality of the knowledge economy at a political level by securing a real shift of resources away from areas such as agricultural subsidy and towards research and innovation. Getting the necessary political backing cannot be achieved by an argument based solely upon the health of research. Rather, it needs to be supported by a clearer public appreciation that research, and the skills that research sustains, are critical elements in addressing the economic, social and environmental problems facing the EU. For this reason our central recommendation was that ERA should be constructed as an essential element of Europe's response to a series of Grand Challenges.

These are a series of coordinated actions encompassing research, but also innovation and the development of lead markets and/or regulatory and public service environments. Examples would be challenges rooted in energy (for example carbon capture), food security, the ageing population or responding to major emerging new scientific opportunities. These would seek to capture political and public imagination, create widespread interest through scientific and business communities and NGOs and inspire younger people. Within these the Framework Programme could be a catalyst but the prime impetus must come from Member States and partners in business and societal groups. They would involve large-scale commitments, costing possibly several billions of Euros. While business would almost certainly be involved what distinguishes these more socially-based challenges is that governments have to be the champions and initiators.

Beyond the Grand Challenges we believe that there is scope for a further reorientation of European research in close support of policies which are developed or regulated at European level in areas such as the environment, transport, energy, agriculture and health. For example, a better connection would ensure that new environmental regulations are based on the best available science.

Achieving these ambitious goals requires a research system fit for purpose and supported by measures to make it more effective throughout Europe. We summarise these as the development of a research-friendly ecology. The concept of the research-friendly ecology is best understood through the needs of its key actors and we explore the roles for research funding organisations in driving up quality; universities as key brokers between research and education; business in terms of how to achieve engagement in ERA; Research and Technology Organisations as players in a new European market for applied research; mobility of researchers as an instrument of knowledge transfer, especially across sectors; and citizens in terms of engagement.

This interdependent trio of Grand Challenges, policy relevance and a research-friendly ecology could transform the impact and standing of research in Europe. Up to now, what has been lacking is the drive, direction and imagination among Europe's political actors to take forward these concepts on a scale that will truly make a difference to the fortunes of its economies and the lives of its citizens.

Syngenta

Andrew Coker is Head of Corporate Affairs UK at Syngenta.

SYNGENTA, one of the worlds leading plant science businesses, was created in 2000 through the merger of Novartis and AstraZeneca's agribusinesses. The company is committed to sustainable agriculture through innovative research and technology. The company is a leader in crop protection, and ranks third in the high-value commercial seeds market. Sales in 2007 were approximately $9.2 billion. The company employs over 21,000 people in more than 90 countries.

Syngenta has six UK sites of which the largest is Jealott's Hill International Research Centre near Bracknell in Berkshire. Jealott's Hill is Europe's leading agricultural research centre employing over 800 scientists in state of the art facilities. The research carried out on site is of global significance, with expert scientists in many different disciplines collaborating to discover new solutions to combat pests and crop diseases. The process from initial discovery to product launch can take up to 15 years, with much of that being dedicated to tests to prove product safety as well as efficacy. Even after a new product is registered for use there is continuous assessment to ensure its efficacy and that there is no detrimental affect on human health or the environment.

Syngenta's research in the UK plays a vital role in global food supply. Through a combination of factors, from poor harvests to the increasingly unpredictable nature of the weather, stocks of grain are at their lowest for decades. Yet politicians and the public have, until very recently, taken little interest in where and how their daily bread is produced.

The task

The Global population is currently about 6.6 billion. It has more than doubled in the past 50 years. By 2050 it is estimated that the human race will be nearly 9.5 billion.

As well as extra mouths to feed, emerging economies are developing at a rapid rate, and their tastes are changing! There is a greater demand for a wider range of food. Rearing meat takes a lot of grain. The best estimates are that overall grain demand will grow by 50 per cent between now and 2030.

Agricultural production will have to double to meet the demand for food, feed, fuel and fibre through sustainable ways of producing more, while using less. There is an argument that there really is no food shortage and that everything would be fine, if we only found better ways to distribute food. It is true that there is enough food for everyone in today's world – and at much lower prices - this is only the case because dramatic advances were made in agricultural practices over the last decades. A key aspect of these advances were productivity increases through new seed varieties, new cultivation practices and new crop protection products.

Had the agricultural practices common around 1950 not been dramatically improved upon, an additional 1 billion hectares of land under cultivation would be needed to produce as much food as we do today. Since 1960 we have more than doubled agricultural production everywhere except sub-Saharan Africa and where yields have increased, the proportion of people living in poverty has reduced. The view that Latin American countries 'have to sell' to Europe is not sustainable and as the global forces of supply and demand shift, Europe may find itself paying a higher price. The price charged by countries such as Argentina for producing non-GM crops to feed European livestock is likely to be a premium one – if they will send us them at all, given the high risk of being turned back because of the EU's zero tolerance on cross contamination.

Europe is in a climatically favourable zone with sufficient water, excellent soils, highly trained farmers, and the world's best infrastructure. The EU has ideal components for a productive farming sector and, as such, Europe is the world's most efficient producer of wheat providing comparative advantage and significant export potential. If the predictions of climate change prove correct, Europe will become even more critical because impact here is both manageable and creates opportunities for longer growing seasons. It would be irresponsible and immoral not to utilise this in the provision of affordable and nutritious food both for Europe and the world.

A new EU Regulation governing access to pesticides in Europe could remove up to 15% of the most active substances. The UK's Pesticide Safety Directorate found that the impact of the Commission's proposal on UK agriculture would be a 20-30% yield reduction annually in cereals and much more in other crops.

At the same time that the farmer's hand is being tied behind his back on pesticides, the EU continues to drag its feet on the approval of the cultivation of GM crops in the EU. This approval system is fundamentally built around obstruction not safety and the only thing the EU seems intent on exporting is 'technophobia'. So agricultural biotechnology in the form of GM crops is not permitted to be grown, yet we allow the import of commodities which have been grown using the same GM technologies outside the EU.

At Syngenta we spend more than $800m every year on research and employ 4,000 scientists working to discover more about plants and to find the answers that become the products and insights that help farmers to meet our increasing demands. We also have hundreds of collaborations and partnerships fostering innovation with leading universities, research institutes and private companies around the world.

If you wish to receive more information about Syngenta please contact Andrew Coker at andrew.coker@syngenta.com

About CaSE

CaSE Member Organisations

CaSE is delighted to welcome a wide range of new organisations that have joined over the last year and we thought it would be of interest to all of our members to see our current profile. We try to secure a good representation of organisations across all sectors with an interest in science, engineering, technology and mathematics.
We greatly appreciate the support and engagement of all our members without which our work would not be possible. Please do contact our Membership Officer, David Hawksett, if you have any suggestions for other organisations that might be interested in joining CaSE, on 020 7679 4994 or david@sciencecampaign.org.uk.

Companies

Astra Zeneca
Wiley-Blackwell
GlaxoSmithKline
Incutio
Johnson Matthey
Merck Sharp & Dohme
Microsoft
Norwich Research Park
Ordnance Survey
Pfizer
QinetiQ
Sharp Laboratories
Syngenta
Unilever

Learned & Professional Societies

The Biochemical Society
The British Ecological Society
The British Pharmacological Society
The British Psychological Society
The Deans of Science
Experimental Psychology Society
The Genetics Society
Heads of Chemistry UK
Institute of Biology
Institute of Mathematics and its Applications
The Institution of Chemical Engineers
The Institution of Engineering & Technology
The Institution of Mechanical Engineers
Institute of Physics
London Mathematical Society
The Physiological Society
Royal Astronomical Society
The Royal Pharmaceutical Society of Great Britain
The Royal Society of Chemistry
Royal Statistical Society
Society for Experimental Biology
Society for General Microbiology
Zoological Society of London

Charities

Association of Medical Research Charities
Breast Cancer Campaign
British Library

Universities & Institutes

Brunel University
Cardiff University
Heriot-Watt University
Imperial College of Science, Technology & Medicine
Institute of Food Research
Kings College London
Kingston University
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London Metropolitan University
London School of Hygiene & Tropical Medicine
London School of Pharmacy
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Membership Benefits

CaSE's work is supported by it members because it is a proven champion of science and engineering in the UK. CaSE members also receive:

- Invites to Opinion Forums, Annual General Meeting and Lecture and launch events
- Copies of our newsletter, policy reports, Annual Review, and monthly updates
- Ability to set direction through annual membership survey
- Ability to engage in our policy activities
- Membership pieces in CaSE's newsletter

CaSE Updates

If you'd like to know more about CaSE's recent activities and also what CaSE is planning, then please sign up for the CaSE monthly email update by emailing nickh@sciencecampaign.org.uk. You can also visit the members' area of our website at www.sciencecampaign.org.uk.

We now post and circulate information on the consultations and inquiries that responses are being planned for as well as various CaSE projects - we always welcome input from our members so do not hesitate to call or email the CaSE office with any comments.