THE FOUNDATION FOR SCIENCE AND TECHNOLOGY

DINNER/DISCUSSION SUMMARY

The Scientific Century: securing our future prosperity
A meeting to celebrate the 350th Anniversary of The Royal Society

A joint meeting with The Royal Society held at the Society on 16th June, 2010

The Foundation is grateful for the support for this meeting from
the Council for Science and Technology and the Michael John Trust

Chair: **The Earl of Selborne KBE FRS**
Chairman, The Foundation for Science and Technology

Speakers: **The Lord Rees OM Kt PRS HonFREng**
President, The Royal Society
Sir Paul Nurse FRS FMedSci
Council for Science and Technology and The Rockefeller University
Sir Richard Friend FRS FREng
Cavendish Laboratory, University of Cambridge
Professor Adrian Smith FRS
Director General Science and Research, Department for Business, Innovation and Skills

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LORD REES spelt out the central messages of the Royal Society's report published in March - *The Scientific Century: securing our future prosperity*[1]. The UK is punching above its weight in research and science; our economy and society depend on science and innovation; we are falling behind our competitors - the US, France, Germany and the Far East - in funding research and innovation. The strength of the UK is based on its universities; and those which produce high quality research should be valued as of national importance - in the way that the USA values Harvard, MIT and Stanford. Such universities are at the centre of international networks attracting scientists, enabling innovation to be exploited and knowledge shared. The UK must continue to attract world class faculty and students, but that means a consistent long term funding policy and the assurance that researchers can follow their own enthusiasms in their disciplines. A decision to follow a particular discipline is not a frivolous choice; it is fundamental to a researcher's life and success. We must avoid an audit approach that seeks to define short term results and ignores how science works. For researchers starting their careers there is a lack of options for those who need time to mature, make false starts and wish to combine study with work. The divide between further and higher education is too rigid and universities themselves try to spread themselves too widely and not specialize in their own strengths. Universities must consider radical restructuring, such as regional grouping, accepting that training PhDs should take place only where there is a strong research base in the appropriate discipline, and that not all universities need do all subjects at undergraduate level - look at the success of liberal arts colleges in the USA. They must also take more risks in widening intake - which inevitably means greater "wastage". The first recommendation of the Society report was "Put science and innovation at the heart of a strategy for long term economic growth": this meant evolving a culture of optimism for those taking up scientific careers, stable and long term funding, international mobility of ideas and people and closer links with industry.

SIR PAUL NURSE endorsed Lord Rees's comments. The Report from the Council for Science and Technology (who he was representing at this meeting) *The Vision for UK Science* had identified three key messages: first that scientific research was vital for the UK; second, that the emphasis should be on people, not projects; third that we must get better at translating research into successful business and industry. A scientist must respect reliable data, have a consistent general view of the world, be sceptical, pursue ideas which can be tested, understand that ideas at the edge can only be tentative, but that those are the ideas that might change the world. Such scientists are individualistic - intensely curious and sceptical. They cannot be driven by direction. But society wants problems answered. The trick is to inspire scientists so that their curiosity is focussed on dealing with problems relevant to society. Scientific success benefits all areas of life and enriches our culture. Those countries that invest in it do well - we must do better. We must seek good scientists from abroad and grow them at home; we must inspire them and retain them. High quality scientists will identify good projects. We need to strengthen our system for identifying and training potential high quality scientists from primary school to PhD level. We should be examining the Masters and PhD structures to ensure that there is a wide skill base and a proper selection of those going on to do research. This might be a smaller, but more focussed cohort of PhDs. He supported the idea of "Newton Scholarships ", giving direct grants to outstanding scientists. This would show the UK was serious about science. Nobody really knows how to translate research into the world, but the USA do it better than most. They have an entrepreneurial culture, they understand that innovation does not come quickly, so fund it appropriately, and they encourage permeability between academia, business and public service. We need to do all these things. We also need to get scientists to engage with the public, enter into dialogues about contentious areas. Scientists need a "Licence to operate"; they will not get it without public support.

SIR RICHARD FRIEND strongly supported the recommendations in the Society's report, particularly the recommendation that there must be a long term framework which can assure scientists that long term projects will be carried through to conclusion, and that new opportunities will arise. Taxpayer's money was essential to support innovation, as the time scale between research and eventual industrialization was long - some 20 years. The life sciences, through the scale of big pharmaceutical companies, have been able to make progress, because funding can be phased over years, but that solution did not apply in the physical sciences. In renewable energy, for example, we do not know the future - what the regulatory restraints will be, what the taxation system and carbon pricing scenarios will be, and what technologies will be most successful. Should we then not bother to innovate ourselves and simply import technology? Possible but disastrous if we are looking to develop major UK industries. We have the research

[1] The Scientific Century – securing our future prosperity, The Royal Society, March 2010, p1-72

base; we need to have the incentives to go further. Crucial to this is developing high tech industries around universities – such as Cambridge - and encouraging top class scientists to work in them as well as in academia. He was not dismayed that only 3.5 per cent of PhDs worked in academia, if the bulk of the rest worked in industry (as well, possibly in the City). But the University itself will be the source of the best research and there should be continuous movement between academia and industry - industry saying what the problems are and academia researching solutions. He strongly supported the recommendations of the Hauser Report to set up intermediate technology centres (Clerk Maxwell Centres) which would support development of research into innovation, as there were no longer many large research laboratories funded by major companies. Such centres would also improve the career structures for scientists working in both business and academia.

PROFESSOR ADRIAN SMITH said that the Department of Business, Innovation and Skills (BIS) spent in round numbers £6bn a year on research - £4bn to research Councils, £2bn to Universities through QR. There has been ten years of increased budgets, and a 12 per cent increase in funds allocated through the RAE (Research Assessment Exercise). This had come about largely through expansion of the sector, but there is no reason to assume that we have got the proportions right. BIS is consulting about the future - with the Royal Society and others - and all are agreed that we need stability and vision, while not losing sight of excellence. But what does this mean in practice? Historically 90% of research funding goes to 14 institutions. This will not change, and there is pressure for even more concentration. What does such concentration mean for access and for geographical spread of research and disciplines? BIS does not doubt the success of the £6bn of expenditure - we outperform other countries and the benefits in terms of better policies, more skilled people, improvement of existing businesses, creation of new businesses and the intake of globally mobile investment are acknowledged. We are getting better at developing relations between academia and business through spin offs and knowledge transfer, and we have attracted over 200 R&D projects into the UK because of the strength of our research base. We must support interdisciplinary projects which face global challenges, if we are to be successful. But, is 15% the right fraction of the total spend to support them? Continuing challenges were how to prioritise expenditure; and what methodology to use; how to promote the culture of business and academia working together, with freedom to move between sectors; how to encourage greater collaboration between institutions, creating critical masses, such as Cambridge; and how to describe the importance of research and the impact that it makes on all our lives, to a sceptical public.

A number of speakers, in the following discussion, raised concerns about whether we had devised adequate policies for translating research into business opportunities. The Panel were right to identify long time scales and large investment as necessary to bring research through to commercialisation; and the Hauser recommendation for Intermediate Technology Centres were endorsed. But these did not wholly meet the need to get small companies, big companies and academia to work together. Nor did it address the problem of lack of capital, if venture capitalists refused to support new companies directly. In such cases, big companies would need to act as venture capitalists themselves to support small companies. It was clear, from the Cambridge Science Park, that big companies needed the drive and technical experience of small companies to help them develop projects; small companies needed market channgels, or they would be taken over and sold, academia needed the possibility of exploiting the entrepreneurship of its faculty members. The pharmaceutical industry had made progress on these lines, but there was insufficient impetus to create better working arrangements. Singapore was cited as an example of how it could be done. Germany had a culture where high tech companies and universities worked together in producing well-trained scientists exploiting research. It was not realistic to assume that if universities cut back on their research because of lack of funding, big international companies would expand their development programmes in this country; they would not, they would move abroad. Research investment - either directly or through funding universities - by international companies was very mobile; it went; project by project, to those countries which offered the best terms and had the best people. This had implications for the UK, in terms both of funding, of institutions (such as Hauser centres) and, above all, for the mobility of professional scientists, both internally from academia to business, and internationally from country to country. Because we had been an attractive environment for scientists we had attracted outstanding scientists into our faculties, and outstanding students. Some of the latter then went home, but their UK experience benefited us as they would be sympathetic to UK ideas and projects. We must be careful not to impose barriers to foreign recruitment of either faculty or students. We must also make efforts to get international companies with fast expanding manufacturing sectors, such as India, Japan and China, to develop research centres in the UK.

Speakers also endorsed Sir Paul Nurse's view of the characteristics of scientists - highly individualistic, driven by passion for their subject, and so unlikely to respond to direction. But the government still had to solve the question of how to meet what they considered national priorities. The only way forward was for the government to devise a broad-brush approach incorporating social values while leaving it to institutions and individuals to focus on different projects. It was not possible to grade individual projects on a rate of return basis. While we knew, in aggregate, the rate of return in different areas, we did not know - and by definition could not know - the rate of return on new and innovative individual projects. Individual scientists would respond to the need to work on areas such as climate change or world hunger from idealistic motives, if they knew that such work would lead, if not to great financial reward, to meeting global needs.

The conclusion from what the speakers had said was that the Universities must be prepared for significant cuts, and that much of the responsibility for ensuring that these cuts did not jeopardise the scientific base, and the UK's leading position rested with them. They must be prepared to accept radical restructuring, of which some features had been suggested by Lord Rees. They will have to define, institution by institution, what their objectives and mission are. It will not be, and should not be, the same in every case. Not every university should seek to train PhDs, or cover all subjects. But they will still need to remember that they must teach, and teaching is enhanced if research activity is going on. Many of their science graduates will be taking run of the mill jobs, for which they need a sound base, even if they can not do research. They must not "pull up the drawbridge" by making it harder for students to get into tertiary education, which means much closer collaboration with Further Education (FE) colleges, a blurring of boundaries between FE and Higher Education and more flexible degree structures. This had implications for science teaching at primary and secondary school level. Students must come to tertiary education with a better grounding in science than at present. This meant better science teaching, more science graduates going into teaching and much greater efforts by those in universities to visit schools and inspire students with their own enthusiasms. They must also accept the hard headed approach of their customers - for companies it would be how much money can we make from this project; for students it would be what is in it for their career.

The Panel were asked how they would see their aspirations being fulfilled. Their response had been indicated in their presentations - greater mobility internationally for scientists, and preservation of the university system; more permeability of scientists between academia and industry; large numbers of PhDs going into industry; and Ministerial acceptance of many of the recommendations of Society's report.

Sir Geoffrey Chipperfield KCB

Useful URLs are on the next page

1994 Group
www.1994group.ac.uk

Academy of Medical Sciences
www.acmedsci.ac.uk

The British Academy
www.britac.ac.uk

Council for Science and Technology
www.cst.gov.uk

Department for Business, Innovation and Skills
www.bis.gov.uk

The Foundation for Science and Technology
www.foundation.org.uk

Higher Education Funding Council for England
www.hefce.ac.uk/research/ref/impact

Ingenious Britain – a report by Sir James Dyson
www.conservatives.com/news/news_stories/2010/03/dyson_sets_out_plans_to_boost_high_tech_industry.aspx

National Endowment for the Science, Technology and the Arts
www.nesta.org.uk

Research Councils UK
www.rcuk.ac.uk

The Rockefeller University
www.rockefeller.edu

The Royal Academy of Engineering
www.raeng.org.uk

The Royal Society
www.royalsociety.org

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