THE FOUNDATION FOR SCIENCE AND TECHNOLOGY

DINNER/DISCUSSION SUMMARY

Is the science education system supplying the skills that the UK wants?

Held at The Royal Society on 28th April, 2010

The Foundation is grateful for the support for this meeting from
the Engineering and Physical Sciences Research Council,
the Institute of Physics, Lloyd's Register Educational Trust and
the Science and the Technology Facilities Council.

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

Speakers: **Sir Mark Walport FMedSci**
Director, The Wellcome Trust and Member, Prime Minister's Council for Science and Technology
Sir John Holman
Director, National Science Learning Centre, York
Professor Lisa Jardine CBE
Centre for Editing Lives and Letters, Queen Mary, London and Chair, Human Fertilisation and Embryology Authority

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SIR MARK WALPORT (Chairman of the Science and Learning Expert Group) summarised the main findings of that Group's February 2010 Report "Science and Mathematics Secondary Education for the 21st Century" – the latest in a succession of such reports stretching back over 150 years. There had recently been some positive signs about the state of science education in schools (rising levels of participation, sustained central investment and a reasonable score in reputable international comparisons). But some major problems needed attention at a time when the economy's need for a highly educated population had never been greater. There was a shortage of specialist teachers in STEM subjects (science, technology, engineering and mathematics). A worryingly large proportion of students entering higher education to study these subjects lacked the required levels of skills and knowledge, especially in maths.

The Expert Group had identified five key areas for remedial action – teaching, curriculum, assessment, school ethos and governance, and market pull. Teaching needed to be in the hands of subject specialists and such specialists needed to be closely involved in the design of curricula and examinations. Too many such teachers did not stay in the profession (a recent study had shown that 40 per cent left within five years). Greater attention to the provision of continuous professional development and to the provision of adequate technician support could help with retention. The science curriculum for 14-18 year olds needed a stronger maths content and more scope for in depth learning. Much action was needed in the area of assessment to reduce the overall burden and to raise quality. Examination bodies needed better regulation to ensure that competition between them raised standards rather than lowered them. Further examination bodies should be debarred from endorsing text books. Governing bodies needed to ensure that schools had effective mechanisms to foster and maintain a commitment to excellence in STEM education.

Much more needed to be done to ensure that pupils were well informed about STEM careers. Closer links between schools and Higher Education Institutions (HEIs) and between schools and employers would help with this. Sir Mark hoped that in the future there would be fewer reports and more action on the recommendations contained in his and earlier such reports.

SIR JOHN HOLMAN agreed that the quality of teachers was fundamental for the quality of the education system. The task of the National Science Learning Centre at York was to improve the quality of teaching. He welcomed the fact that in the National Curriculum science was a core subject so that children were introduced to science at the outset of primary education; there was evidence to suggest that many young people who chose science and engineering for their careers had done so by the age of 14. Although the recent abolition of compulsory testing for science was welcome, there was a risk that, in an environment of league tables, schools would reduce the importance attached to the subject and would pay insufficient attention to ensuring that science teachers at the primary level had the required levels of knowledge to teach the subject with confidence. He stressed the vital need for maths as a subject which underpinned the other three STEM subjects. He welcomed the signs that maths was the A level subject achieving the fastest growth rates, admittedly from a low base. He noted that a recent CBI study had shown that 40 per cent of employers preferred graduates with degrees in STEM subjects as compared with one per cent for humanities. But he also noted that 42 per cent of employers expressed no subject preference, attaching importance to general employability skills rather than to specific subject knowledge. Education in STEM subjects was needed not just to provide for an adequate supply of engineering and science graduates; there was a serious shortage of technicians. He lamented the undervaluing of the Further Education (FE) sector and stressed the key role which it could play in this area. Finally he argued that good science education was not just an economic priority; a population with a good understanding of science and maths was essential both culturally and for a healthy democracy.

PROFESSOR LISA JARDINE developed further this last point. People at all levels in society – and especially in politics and government where decision makers had to be able to assess advice from scientists – needed to be sufficiently educated to be able properly to assess and evaluate information and evidence. Science pervaded every aspect of modern life yet people generally were woefully ignorant of science and neither understood nor appreciated the value and rigour of scientific method.

She believed that C P Snow's 1961 essays on Science and Government contained lessons of continuing relevance and

importance. She feared that the new post-election House of Commons would contain too few scientifically "literate" Members.
In the subsequent discussion periods much attention was given to the fundamental question of the purposes of education in STEM subjects. There were many speakers who felt that too much emphasis was being given to the need for the education system to ensure the supply of those who would make their careers in such areas. Insufficient weight was being given to the value of STEM subjects as a means for equipping people to live in the modern world. The long-standing rivalry between science and humanities as the essential equipment for a well-educated person still remained and the deep-seated prejudice in favour of the latter persisted. Although the importance for the national economy of a plentiful supply of top quality STEM graduates was undeniable, the importance for society and a stable democracy of a plentiful supply of numerate and scientifically "literate" citizens could not be over-stated.

It was argued that these were not alternatives. There was scope for providing different levels of education in STEM subjects (especially in maths) and ensuring that the system produced both experts and generalists in these subjects. But this would not happen unless sufficient emphasis to both needs was given in curriculum design, examinations, teacher training and development and school governance. There would be resource implications in that effective education in STEM subjects required practical as well as theoretical work; schools needed laboratory and workshop facilities and teachers needed technical support. All schools needed to be able to offer the three sciences as options whereas at present only 60 per cent of schools in England were able so to do.

The discussion also revealed anxiety on the part of some that the tone of the presentations had given excessive emphasis to education for employability. Schools should not confuse training with education. On the other hand it was argued that the motivation of pupils generally increased once they were convinced of the relevance of what they were being taught.

Some speakers thought that there as a strong case for later specialisation in subject content at schools. Adoption of the International Baccalaureat was thought to be desirable.

Concerns were expressed about the ability of the UK to keep pace with international competition. Many of the UK's competitors were thought to give much greater emphasis to STEM subjects but the Panel pointed out that reputable studies had shown that the UK ranked among the top ten in comparisons of performance in science and maths. Nevertheless science and maths did need to be given greater prominence in the curriculum.

Concerns were also expressed about the ability of school governing bodies to play an effective role in ensuring good governance and proper accountability. Legislative changes in the recent past to increase the proportion of parent governors had been to unfortunately reduce the number of governors with special skills. These changes needed to be reversed if some of the recommendations in the Expert Group's report were to be implemented.

There was some discussion about the extent to which employers, FE and HEIs should engage with schools in order to improve the quality and take-up of learning in STEM subjects. Although some speakers were concerned about the resource implications for companies, the Panel was strongly in favour of greater efforts in this regard and saw these as leading to significant benefits both for schools and for employers. As one Panel member pointed out, science education is not just an education for a career; it is an education for life and there was something for all players to do (schools, FE, HEIs and employers) to help bring about the required improvements.

The question of elitism versus equality also surfaced in the discussion. The Panel pointed out that it was inequitable (as well as undesirable) for pupils with above average aptitude to be held back. It was accepted that improvements (especially in the qualifications system) could and should be sought within the existing framework of comprehensive education rather than by reverting to other discarded models.

The key messages to emerge from the evening were that a modern democratic society needed a population educated to be numerate and to understand science and the scientific method and capable of assessing and evaluating information. The ways in which this could be achieved had been extensively explored and scrutinised over the past 150 years; what was needed now was implementation of existing recommendations and not the proliferation of further studies and yet more recommendations. The importance of mathematics could not be overstated but scientists needed also to have good communication skills. Great benefits for the quality of teachers and learning could be achieved by the forging of closer links and co-operation between schools on the one hand and employers, FE and HEIs on the other. The role of FE, especially in the crucial area of technician provision, should not be underestimated.

Sir John Caines KCB

British Science Association
www.britishscienceassociation.org

Engineering and Physical Sciences Research Council
www.epsrc.ac.uk

EngineeringUK
www.engineeringuk.com

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

Institute of Physics
www.iop.org

Lloyd's Register Educational Trust
www.lr.org/about_us/LRET

Professor Lisa Jardine CBE
www.english.qmul.ac.uk/staff/jardinel.html

National Science Learning Centre
www.sciencelearningcentres.org.uk

Research Councils UK
www.rcuk.ac.uk

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

The Royal Society
www.royalsociety.org

Science and Technology Facilities Council
www.stfc.ac.uk

Science and Mathematics Secondary Education
for the 21st Century Report
http://interactive.bis.gov.uk/scienceandsociety/site
/learning/2010/02/25/new-science-and-learning-expert-group-
report/

Science Council
www.sciencecouncil.org

The Wellcome Trust
www.wellcome.ac.uk