THE FOUNDATION FOR SCIENCE AND TECHNOLOGY

DINNER/DISCUSSION SUMMARY

SCIENCE, ENGINEERING AND TECHNOLOGY

Held at The Royal Society, 6 Carlton House Terrace, London SW1Y 5AG
Tuesday 25th June 2002

Sponsored by
The Royal Commission for the Exhibition of 1851

In the Chair: **The Rt Hon the Lord Jenkin of Roding**
Chairman, The Foundation for Science and Technology

Speakers: **The Lord May of Oxford AC PRS**
President, The Royal Society
Sir Peter Williams CBE FRS FREng
Chairman, The Engineering and Technology Board
Sir Alec Broers FRS FREng
President, The Royal Academy of Engineering

LORD MAY stressed the seamless role of culture and the arbitrary nature of institutional boundaries. He regretted, for example, that the British Academy had not remained part of the Royal Society, and saw it and other academies as all being engaged in the pursuit of " natural knowledge". Judging from the UK entries in bibliographic reference, he thought we did better than most in multidisciplinary work – notwithstanding concern that the Research Assessment Exercise might be hindering it; but we could do better. Institutional barriers were weakening – note the way that the CEO of the Engineering and Technology Board had been chosen. But institutional structures were unimportant compared with instilling a proper attitude in education to the pursuit of "natural knowledge". This was not learning lists of facts; it was being taught to ask questions, to understand the nature of evidence, to experiment and to accept that science and engineering raised ethical questions and must respond to public concern about application of knowledge. The message must be broadcast that scientific standards of enquiry are for the public good and that science is an integral component of society.

SIR PETER WILLIAMS said that in industry there was a continuum of effort through research down to the shop floor; boundaries were inevitably artificial. Development and commercialisation of major technological or scientific breakthroughs – such as Magnetic Resonance Imaging – involved scientists, engineers, technocrats, medics, marketeers, financiers, and mechanics. Backgrounds merge automatically when people work in teams on multidisciplinary projects. Provided industry had trained people (and money!) there was no problem; the real problem was that students did not want to study the disciplines that would give them the training. The Roberts Report painted a dismal picture. Why was it that the evident enthusiasm of children for understanding how nature worked evaporated? Among many reasons were the forced choice of subjects at 16, boring teaching, and the image of industry. A key task of the Research Councils UK (RCUK) and the institutions was to reverse the trends Roberts[1] identifies by raising the image of work in industry, improving teaching and making the cohesion between science and engineering more evident.

SIR ALEC BROERS endorsed the previous speaker's view that significant discoveries were developed and commercialised by a range of professions working in teams in industries. The development of magnetic disk recorders, electronic vacuum valves, transistors and integrated circuit chips had come about through teams of scientists and engineers – and others - working together. The histories of such developments showed that revolutionary technical advances tended to come from attempting to solve problems at the frontiers of knowledge, not from quantum leaps in theoretical research; that developing such advances takes a long time with integrated team work; that while

[1] www.hm-treasury.gov.uk/mediastore/otherfiles/ACF11FD.pdf

development often takes place in large companies, exploitation of concepts is often not in the business interest of such companies and is best done by start ups or spin offs, when ability to seize the fleeting moment and commandeer resources are vital. All learn from the process – scientists begin to understand the practicalities of implementation and engineers the scientific basis which controls implementation; professions lose their separate identity.

While a principal theme in the following discussion was the effect that different professional requirements in the tertiary sector might have on the ability of scientists and engineers to promote and develop multidisciplinary activities, many speakers echoed the points made by the lecturers that the initial problem was getting students to undertake scientific and engineering studies at all. Apart from points already made, speakers stressed the poor quality of teaching in science and mathematics – as Roberts noted, many teachers in those subjects had little or no grounding in them. But there was a marked contrast between biological and physical sciences – the former were much more popular, and much better qualified teachers had taught applicants. So the key was getting scientifically qualified teachers into schools. But, given the indiscipline in schools, the low status of teachers, and other opportunities, why would any scientist want to teach? Only, perhaps, if they experienced teaching and discovered the satisfaction of opening and developing young minds. Thus Sir Richard Sykes' scheme for getting young scientists into schools to teach for a period without committing themselves finally was warmly to be welcomed. But a further problem was the poor quality of career advice in schools – one speaker said that advice had been given that Universities would be less likely to accept science and mathematics students than other subjects. Other speakers doubted this, but supported the view that advisers had little or no knowledge of lifetime earnings of engineers and scientists – which compared well with accountants and other professions. If this were true more effort needed to be made by institutions, not only to demonstrate material rewords, but also the excitement of solving problems. If schools could muster the resources to promote project work, this excitement would be evident at an early stage.

But, even while acknowledging these problems in secondary education, there were still difficulties in the tertiary sector in promoting multidisciplinarity. There was, for example the gap between physical and biological scientists. This might be traced back to a fundamental difference between the lineal and hierarchical structure of mathematics which requires a long background of teaching, compared with the more immediate descriptive structure of biological science, but there was no reason why the two sciences could not learn more from each other – note that MIT requires all students to study biology and biologists need maths. Some speakers thought that there was an inherent problem in Universities focussing on teamwork, because there were difficulties in examining on it, and it was impossible to reduce the content of individual science courses without risking failure to get accreditation. There was also the danger of getting breadth without width – of dumbing down. But other speakers said that it was possible to examine and accredit at team level; but, more important, if it were right to teach multidisciplinary themes and work, then they should and must be taught. "Dumbing down " was a red herring; there was no reason why the search for wider participation – which meant taking students who did not have conventional academic records – or demanding a wider cultural understanding should lead to lower outputs, but it required more imaginative and specially focussed teaching to release potential. It was crucial to get away from the idea that multidisciplinary meant "soft" while digging in your silo meant "hard". But Universities had one great advantage – they had (even if not enough) irreverent and experimental young who made a culture of innovation and cross-fertilisation more likely. Research money should therefore go either to them or to industrial research departments, which were focussed on solving problems which were barriers to commercial success. Research Institutes were not the answer; the dangers of middle-aged consensus and lack of focus were too great. What lay behind the call for multidisciplinarity was the view that rigid professional structures and training inhibited innovation and development. But barriers and lack of understanding between the different worlds of academia, industry and the City were equally inhibiting. Scientists and engineers should be encouraged to carry their experience and knowledge across these worlds. This meant not only devising much more flexible career paths, but also developing respect and understanding in each of these worlds for the value and achievements of the others. There must be no more suggestion that scientists who go into industry are "selling out" or into the City that they are "wasting their degrees".

While there was some criticism of professional institutions, some of whose attitudes were historically restrictive, and some of whose leaders were caustically described as "past their sell by date", there was also recognition that they were actively seeking to advance multidisciplinary working and were co-operating with the development of the Engineering and Technology Board and RCUK. There were, for example, more paths opening up for the award of Chartered Engineer status and dual membership of institutions with a single qualification becoming possible. But Institutions were still, in essence, tribes or clubs and the aim of the founders of the 1851 Commission to get science and art to work together for the requirements of industry, still had work to do. Collaboration depended essentially on the individuals who were willing to make multidisciplinary processes work, and there was still sand in the institutional structures. One speaker described his "random walk" in science, through various disciplines, and noted that this had lead to him failing to attain membership of one professional body.

Sir Geoffrey Chipperfield KCB

The discussion was held under the Foundation's Rule that the speakers may be named but those who contribute in the discussion are not. None of the opinions stated are those of the Foundation which maintains a strictly neutral position.