

ROYAL SOCIETY OF CHEMISTRY LINKS DAY – WEDNESDAY 24TH JUNE 2009

SCIENCE AND GLOBAL SECURITY

John Bercow, the recently elected Speaker, put in an unexpected visit prior to the start of the proceedings. He referred to the network of scientific organisations responsible for putting in place the biggest scientific and engineering event of the year in Parliament and the need for everyone to be fully aware of its significance. He pointed out that science and engineering are directly relevant to many areas of public policy, particularly so today, and wished everyone a great day and successful year.

Brian Iddon FRSC MP rose to commence the formal proceedings and welcome the guests. He introduced Professor Dave Garner FRSC FRS, President of the Royal Society of Chemistry, who referred to the importance and power of scientists acting



Adam Afriyie MP

collectively and either hanging together or hanging separately. For example, global security requires constant surveillance in order to monitor rogue states and to ensure sustainability for 9 billion people. The Royal Society of Chemistry has taken the lead with a roadmap which now requires fundamental research and funding. He then introduced Hilary Benn MP, Secretary of State for Environment, Rural Affairs and Food, having emerged unscathed from the turmoil of



Rt Hon John Bercow MP



Phil Willis MP



Rt Hon Hilary Benn MP

recent weeks, to deliver the Keynote Address on Science and Global Security.

Hilary Benn referred to a crisis of sustainability which required deep understanding between Parliament, Science and Engineering, all of which impact on Global Security. Obama has restored science to its primal place in US Government policy, and in the UK Bob Watson demands the best evidence we can obtain on which to base future policy. The UK punches above its weight on the world stage where India and China are emerging as superpowers, resulting in more demand for our expertise worldwide. Climate change maps for the end of this century indicate potential changes resulting in temperature increases of 2°-6°C; the hot summer of 2003 is estimated to have been responsible for the deaths of 35,000 people; sea level in London is predicted to rise by 36cms where an average temperature of 36°C is anticipated. Scientists and engineers will have to work very hard to adapt our environment to cope with and minimise such rapid and drastic change that may be accompanied by the import of new diseases. Food security needed a new Norman Borlaug to lead a new Green Revolution to feed an increasingly hungry world. Carbon Capture and Storage (CCS) is also urgently required, based on developing partnership across the globe between scientists and engineers to bring this about. People will migrate towards increasingly scarce sources of fresh water and also towards India from low-lying coastal areas such as Bangladesh as it sinks beneath the Bay of Bengal. We cannot escape climate change, but we can attract young people to study the implications and devise solutions and help to minimise impacts before it is too late!

A series of summary Scientific Presentations delivered by six speakers then followed, each with a different and specific scientific or engineering message related to Science and Global Security. Lord Rees, President of the Royal Society, led off on the urgent need to rebalance our economy from one solely concerned with finance to one based on high technology manufacturing even though the payoff sometimes takes decades. The UK has expertise in:

1. Spearheading the world's CCS requirements, which is crucial in the light of China's 100 coal fired power stations built last year alone;
2. Promoting energy storage using batteries;
3. Developing Nuclear Power with 4th Generation Reactors;
4. Proving and developing Nuclear Fusion as a clean source of Energy;
5. Developing solar power in the Sahara and transmitting via HVDC cable.

The alternative and pessimistic 'Plan B' in which we never achieve our goals, envisages global population growing from 3 billion 50 years ago to 6 billion currently, to an estimated 9 billion by 2050, with a billion more in Africa alone, requiring a second Green Revolution to feed the world, which will force science up the agenda, as in the Royal Society's "Future Curiosity" programme.

Dr Scott Steedman, Royal Academy of Engineering, with 1000 Fellows and 250,000 Chartered Engineers underpinning "Engineering the Future", sees many opportunities for high profile work in three main areas, Energy, CCS and the Environment with policy issues focusing on water security and DECC.

Alan Pratt, Institute of Physics, referred to 2500 enquiries received by the Home Office

Scientific Development Branch where science was used in the response. He presented a case for the application of physics, in conjunction with other scientific disciplines, to counter terrorism in four areas, the 4 Ps: Prepare, Prevent, Protect, Pursue, with particular reference to Chemical, Biological, Radiation and Nuclear (CBRN) attacks. Challenges are ongoing where science and technology are essential and threats must be tackled in an integrated manner.

Professor Alan Malcolm, Biosciences Federation and Institute of Biology, referred to the current underestimation of the need for "Natural Capital" such as:

1. Fresh water, eg where fresh water availability per head of population is decreasing as population increases;
2. Acidity of the oceans is increasing very rapidly due to the uptake of increasing amounts of CO₂ from the atmosphere;
3. Bees and other crop pollinators urgently require scientific study if their decline is to be arrested before it is too late;
4. Wind farms and their possible negative impacts on bird migration and radar monitors;

Professor Paul Monks, Royal Society of Chemistry, emphasised the role of Earth Observation Science and data collection from global to local scale as a health check and for specific studies related to tropical deforestation resulting in loss of the earth's lungs, decreasing biodiversity, and increased greenhouse gas emissions which are facilitated by the use of high resolution radar for detection of logging tracks. Illegal logging in Indonesia requires very rapid response times from radar if it is to provide an effective means of control. It is also possible to identify emission and uptake by plants of

greenhouse gases from space.

Air pollution, which gives rise to between 12,000 and 24,000 deaths in the UK annually, can also be monitored. Information on air quality can help reduce hospital admissions by dissemination of air quality data by mobile phone as part of a GMES (Global Module for Environmental Security) for business, covering marine, atmospheric and land based emergencies. Hence science can now bridge observational and societal benefits while the world faces a 'perfect storm' of problems by 2030, as the Chief Scientist warns.

Dr Richard Herrington, Geological Society of London, discussed the challenges of maintaining a sustainable mineral supply for a wide range of metals, energy minerals, industrial minerals and raw materials for the construction industry. The southern hemisphere is currently the location for many of the world's mineral deposits, raising questions concerning security of supply, technological innovation and substitution. For example, the BRIC Countries (Brazil, Russia, India and China) are changing from net exporters to importers of raw materials as their own domestic economies grow, resulting in increased competition for scarce resources, even to the point of armed conflict such as conflict diamonds from certain locations in West Africa and Tantalum for mobile phones obtained from a relatively few deposits in the DRC (Democratic Republic of Congo). China now controls the global supply of Rare Earth Elements (REE) which are essential to the US military for use in magnets in GPS systems located in Cruise Missiles. Lithium deposits, essential for new generation batteries required for transport, are located in Chile, Argentina and Bolivia. Science thus plays a major role in predicting location



of new sources of supply, possible substitutions, mitigating risks and minimising waste.

The 'View from Parliament and Government' was introduced by Adam Afriye MP, Shadow Minister for Innovation, Universities and Skills. It has been a turbulent year on many fronts and science is not unaffected by the financial crisis, economic downturn, borrowing difficulties and housing, all emphasising the need for a world-class research base to help rebalance the economy, especially in chemistry, biology, aerospace, pharmaceuticals etc. The lead we maintain in plastic electronics and nanotechnology is also important, as we are not just 'bankers and borrowers' and our universities also attract much attention from Parliament and Government. Recent departmental changes include the move from DIUS and BERR to BIS, a huge department with six Ministers in the House of Lords, restricting the ability to hold the Government to account.

If politicians claim to put science at the heart of Government, they should mean it! Scientific literacy in Parliament is vital if we wish to avoid more MMRs. It will therefore be compulsory for all incoming

Conservative MPs to enrol on a scientific literacy course in future, with emphasis on statistics and scientific concepts. POST has designed a programme for all MPs in Parliament.

Current topics include the need for the independence of science from undue political influence as questions need answers. Should science spending be directed to achieve economic growth? What is the relationship between the science budget and regional development? What is the role and responsibility of the Minister? Scrutiny of scientific policy is essential although it may be the responsibility of more than one select committee. The Science and Technology Select Committee is very important and therefore science will be free to flourish under a Conservative Government lead that recognises the independence of scientific research. There is also need for a longitudinal study of young people to examine how science and society impact on their training in science.

Professor John Beddington, Government Chief Scientific Adviser and Head of the Government Office for Science, summarised in a series of illustrations the increases in

current Global Security Challenges:

1. World Population Growth (increasing)
2. Urbanisation (increasing)
3. Poverty (increasing)
4. World Food Requirements (increasing)
5. World Primary Energy Demand (increasing)
6. Fresh Water Availability – 70% for Agriculture (a massive problem by 2025)
7. Climate Change – Arctic free of ice by 2030 (earlier than the IPCC prediction)
8. Ocean Acidification (sudden recent increase from pH 8.2 to pH 7.6)

These factors will combine to produce the 'perfect storm' involving energy, food and water, coastal vulnerability, mega delta flooding, increasing migration seeking food, water, energy and giving rise to global conflict, a coastal risk of flooding, and demonstrating a need for science, engineering and social and behavioural science resources on a much faster time scale and with particular reference to the increased availability of contraception for women.

Phil Willis MP, Chair, Commons Select Committee for Innovation, Universities, Science and Skills, announced that the meeting is not a wake, thanks to Brian Iddon! With the recent resurrection of the Science and Technology Select Committee, "Science is back at the heart of Government". Government is no good if not scrutinised by a committee championing science. Science is not the exclusive property of a few individuals. A wide range of topics, both local and global, and ranging from tidal power to biofuels, and the Royal input to the GM debate, many of them covered in more detail in the earlier presentations, were briefly summarised as important to the new Select Committee. However, particular reference was also made to the likely combined impact of housing and surface groundwater to water availability in the south east of England where demand for affordable housing exceeds the predicted availability of underground water in aquifers for the current population.

Mark Lancaster TD MP, Shadow Minister for International Development, closed the proceedings and thanked all the speakers.

POTENTIAL HAZARDS OF NANOTECHNOLOGY

Vicki Stone

Professor of Toxicology, Director of the Centre for Nano Safety, Edinburgh Napier University

Rob Aitken

Director of SAFENANO and Director of Consulting, Institute of Occupational Medicine

INTRODUCTION

Nanotechnology is a rapidly developing field of science, technology and industry that has the potential to greatly improve our lives through a diverse array of products and applications; but what is nanotechnology? Nanotechnology involves the production and manipulation of materials at the nanoscale (less than 100nm). To put this into perspective, a human hair is 80,000 nm in diameter, while a red blood cell is 7,000nm. Many of the products made by nanotechnology are nano-objects or nanoparticles, which