FOUNDATION FOR SCIENCE AND TECHNOLOGY EVENT – 18/11
NANOTECHNOLOGY OPPORTUNITIES AND THREATS

Ladies and Gentleman. I am delighted to have been invited to speak at this event on the exciting topic of nanotechnology.

The UK has a strong academic background in nanoscience and nanotechnology and has been active in the field for two decades or more. The National Initiative on Nanotechnology in 1986 was the forerunner of a number of international initiatives. A LINK nanotechnology programme followed in 1988 to 1996 but was not continued.

Nanotechnology research in the UK covers most aspects of the field and much of it can claim to be world class. This research should provide the foundations on which to develop nanotechnology for the benefit of UK companies and for wider society.

Enormous commercial opportunities are predicted from nanotechnology over the course of the next 10 years. For example, the US Government forecast in 2001 that the estimated global market would be £700 billion in 2010. The interdisciplinary nature of nanotechnology and the wide range of sciences it covers, mean its influence could pervade all aspects of society and most industrial sectors. As the Prime Minister said in his speech to the Royal Society last year

"Nanoscience - manipulating and building devices atom by atom – is startling in its potential. This kind of disruptive technology may create whole new industries and products we can't begin to imagine."

Applications of nanotechnology are already emerging and promise to make a significant mark by 2006.

Products already available:

- Hard disks – devices based on giant magnetoresistance in nanostructured magnetic multilayers dominate the market
- Sun-block creams based on nanoparticles that absorb UV light
- Lasers, modulators and amplifiers for telecommunications
- Computer peripherals eg VCSELs, (Vertical Cavity Surface Emitting Lasers).

Applications close to marketplace include:

- Better photovoltaic techniques for renewable energy sources
- Electronic display technologies
- Glasses with scratch resistant coating
- Harder, lighter and stronger materials
- ‘Lab-on-a-chip’ diagnostic technologies
- Quantum structure electronic devices
- Self-cleaning surfaces
- Advanced photonics devices in telecommunications

Taylor Report

However, there have been concerns that UK companies are not commercially exploiting nanotechnology as quickly as our major industrial competitors.

It was with this in mind that I asked Dr John Taylor, Director General of the Research Councils in May 2001, to chair a UK Advisory Group on Nanotechnology Applications to advise on what steps needed to be taken for the UK to build on its existing investments in nanotechnology research to become a world-class player in nanotechnology applications.

The advisory group reported in June 2002 and found that there was a strong foundation on which to develop nanotechnology in the UK but that we were not moving as fast as we should on commercialisation. It was clear that more effort was needed to build on our position as a research leader in nanotechnology in order to become a leader in its commercialisation.

Other Governments and international companies were investing large sums in new facilities but here in the UK we lacked a coherent and coordinated strategy for accelerating the application of nanotechnology and exploiting its benefits as widely as possible across the economy.

The advisory group's report highlighted a number of actions which should be taken:

- the creation of a stable, visible and coordinated strategy for public support
- a reduction in the mismatch between our research and industrial capabilities
- improvements in UK access to international R&D and
- improvements in access to fabrication facilities to enable industry to trial its ideas.

Government Support

In order to understand better and to improve the UK's performance the Advisory Group chose six specific, major application areas and produced success scenarios for each area just five years from now. The six areas chosen were electronics and communications, drug delivery, instrumentations, tooling and metrology, novel materials, sensors and actuators, and tissue engineering. The achievable outcomes from tissue engineering were thought to be :

- Five to 10 start-up businesses every year
- 10 additional multidisciplinary groups every year
- 2 per cent of a $50 billion market, worth $1 billion to the UK
- 85 to 90 per cent of UK tissue engineering companies run by UK managers
- New employment of 1500 jobs
- Eight new products commercialised.

With a view to achieving these outcomes on 2nd July this year, I announced DTI's latest investment in nanotechnology, £90 million over the next six years.

The £90 million will be spent on collaborative research and a new network of micro and nanotechnology facilities. This will help business build on the UK's excellent scientific track record in the small-scale science and win a share of this developing market.

£50 million of this fund will be available for collaborative research and development between industry and our science base. I have been greatly encouraged by the response to our call for expressions of interest. We have received 615 expressions of interest. 41% of them came from industry, 42% from universities, 11% from RTO's and 6% from other organisations.

This £50M fund should incentivise UK companies to take advantage of the strength of our science base to develop new products and processes and also provide their academic partners with new challenges to drive forward new areas of research. Strengthening these collaborative links is vital if we are to gain maximum advantage from the EU Sixth Framework programme, particularly the third priority area of Nanotechnology, Materials and Processes worth some £900 million.

I am delighted that the UK Development Agencies have responded very positively to the creation of a UK MicroNanoTechnology Network. This Network will receive £40 million of this fund to provide industry with access to cutting edge nanotechnology research and resources in academic and industrial facilities throughout the UK. Existing and anticipated micro and nanotechnology projects supported by the UK Development Agencies are expected to exceed £200m over the next few years.

This very substantial investment will help UK companies take advantage of the exciting commercial opportunities offered by scientific advances in nanotechnology and compares very favourably with the level of investment in our major competitor nations.

My officials are in regular contact with other Government Departments and Agencies with a clear interest in nanotechnology such as MOD, Department of Health, DEFRA and all of the Research Councils to ensure that we gain maximum advantage from UK Government investment in nanotechnology.

The RS study

However, some unease about nanotechnology has been expressed recently in the media and by individuals and organisations, with suggestions that plagues of self-replicating nano-bots could turn the world into “grey goo”.

Sensationalist scenarios such as this are very much in the realms of science fiction and far from the reality of what nanotechnology is about and what it can do. But there are other concerns. Concerns about releases into the environment, concerns about possible threats to health and concerns about the unknown properties of materials at the nanoscale.

In their report ‘Scientific Research: Innovation with Controls’, published in January this year, the Better Regulation Task Force identified nanotechnology as an area of great potential but where concerns are likely to be raised about the risks of the technology.

The report states that Government needs to be ready to deal with these concerns and demonstrate that it has clear policies in place to ensure the safety of individuals, animals and the environment, whilst permitting the research to continue.

We agree with the Task Force. We used to deal with these issues under the Public Understanding of Science. But our thinking and approach has now shifted from this “deficit” model to one of positive engagement, as it is essential that scientists and the public have a two way process of constructive dialogue.

It is not simply a case of scientists being prepared to engage in debate, it is also necessary for scientists to do some hard thinking earlier rather than later about the ethical, health and environmental issues raised by emerging technologies. If there is one thing we have learnt in recent years it is surely that we need to think about these issues upstream rather than waiting for the time when they begin to impact upon the public.

The ground breaking work of Mary Warnock in the early days of the science and technology of human fertilisation and embryology surely provides us with a useful precedent.

UK law on embryo research has evolved over 20 years of public and parliamentary debate, beginning with the Committee of Enquiry which she chaired in 1982.

The UK now has one of the most comprehensive schemes of regulation in the world and the careful and thoughtful approach which was taken over this lengthy period enabled us to introduce the necessary regulatory change to enable stem cell research to go ahead.

It was with these lessons in mind that I also recently commissioned the Royal Society and the Royal Academy of Engineering to look at whether nanotechnology raised any ethical, health or environmental issues which are not covered by current regulations, and whether, therefore, we need to introduce new regulations.

The working group will include those with an understanding of ethical, social, consumer and regulatory issues, as well as scientists and engineers.

Once the Royal Society and the Royal Academy of Engineering have publicly reported, and some kind of scientific consensus has been reached, then I would see a wider public debate taking place.

We need to understand first what we mean by nanotechnologies, and then to establish whether there are aspects which should concern us. And if so, we need to look at how well these activities are regulated or whether further regulation is required.

Bodies such as the Health and Safety Executive, the Environment Agency, Trading Standards and the MHRA (the Medicines and Healthcare Products

Regulatory Agency formerly the Medical Devices Agency and the Medical Control Agency) already provide safeguards to protect people and the environment. We hope that the Royal Society Royal Academy of Engineering study will identify if there are further areas where regulation should be considered.

What we should not be trying to do is to say whether overall nanotechnology is a beneficial technology and should be encouraged or a harmful technology and, therefore, should be stopped. No one has the foresight or wisdom to make such decisions.

Conclusion

In the new global economy in which we now live, the UK will not be able to compete on the basis of low costs with countries like China which have 5% of our wage costs. We will only be able to compete on the basis of our knowledge, skills and creativity.

Disruptive technologies such as nanotechnology give us the opportunity to move into new high value-added areas both by creating new industries and by radically changing traditional ones. This is an opportunity we must seize, and the Government will put in place the public goods such as a world-class science and technology base, incentives for knowledge transfer and high educational standards, to enable companies to put innovation at the centre of their strategies. At the same time we need scientists and technologies to give careful thought to any ethical, health and environmental issues raised by nanotechnology, to say whether any new regulatory controls are required, and to enter into an open dialogue with the public. Only in this way will we be able to maintain the confidence of the public and reap the full benefits of this exciting new technology.

1898 words