Managing nanotechnology

Alexis Vlandas discusses some ways in which nanotechnology might be managed to try to prevent negative environmental, security, health or social impacts.

The first European meeting of the International Council on Nanotechnology (ICON) was held in Dublin in January 2006. Created mostly by researchers at the University of Rice in Houston, this is a forum where issues surrounding nanotechnology can be discussed by governments, industry, scientists and 'civil society'. I represented SGR at this meeting and spoke about processes to manage nanotechnology. This article is based on the talk I gave[1].

A good start

We are at a crossroads in science and society, with an opportunity to do things the right way and define how future developments will be discussed and implemented. 'Nanoscience' and 'nanotechnology' are loosely defined as new knowledge and applications with dimensions under 100 nm (1 nm = 10^{-9} m). Many current nanotechnology applications are developments of existing goods and devices, e.g. in electronics and computing, but the increasing control and understanding of matter at the atomic scale and the ability to organise atoms precisely to reveal new properties brings the prospect of truly 'disrupting' technologies in fields such as medicine, energy and materials.

The widely praised 2004 Royal Society/ Royal Academy of Engineers report on nanotechnology[2] (commissioned by the UK government) was probably the first official attempt to anticipate the consequences of this new scientific field for society. However, this good start is now threatened by inertia and lack of political will to implement its recommendations and democratise science-related decision making.

Unlocking knowledge

A large amount of scientific knowledge is not available for decision-making purposes or public debate. This 'locked knowledge' in closed institutions such as private companies or the military establishment is inaccessible because of commercial secrecy or 'national security'. This allows us to have only a partial view of a field, compromising decision-making. Recent drug manufacturing scandals (e.g. Vioxx) have illustrated that even in a highly regulated field, secrecy hinders good decisions. In a world of rapid change, we cannot just 'wait and see', as the consequences could affect humanity as a whole. Ways need to be found to unlock this knowledge.

Part of the solution lies in protection for whistleblowers[3]. We need to make it easier for people working in these closed worlds to expose possible problems.

Casual knowledge

Because of the complexity of the interaction between manufactured nanomaterials and biological systems, laboratory tests cannot reveal all effects. For example, the health impact of semiconductor nanoparticles[4] could be different after they have been immersed in a biological system like a river for some time. We should not stop technologies which have positive consequences but a system is needed to warn quickly of possible dangers.

One way of doing this would be to give credit to 'casual observers': people who may lack formal scientific training but see emerging patterns. Of course many of their observations might be based on imagination or beliefs, but some might contain important information. 'Science shops' like those established in some countries in Europe might be a good structure for collecting data from such people. Recognising the value of this knowledge might help bridge the perceived gap between scientists and civil society.

Agile legislation

Consultations and increased scientific knowledge are almost useless without political will to implement recommendations. The legislative and regulatory process must be reviewed so that it can deal with impacts that are globalised and spread rapidly. It must become faster, more agile, adapting to the evolution of knowledge. So far the UK, USA and EU have failed to update their regulatory frameworks to tackle the challenges posed by artificial nanoparticles.

Recommendations

Changes in legislation should be made quickly to reflect the behaviour of new nanoscale materials. The UK government has failed to build up the independent research capacity in nanotoxicity required for sensible regulatory decisions. We may earmark money for research programmes but end up with no proposals, as has happened in the USA with research funded by the Environmental Protection Agency on environmental nanotoxicity.

In research laboratories, precautions are needed to limit exposure to nanoparticles and nanotubes[5], and in industry efforts should be made to prevent release of loose nanoparticles. Companies need plans to deal with 'end of life' issues associated with new products.

Military funding is a large part of the public nanotechnology R&D effort in western countries (up to 40%), but military research is a closed domain. Since nanotechnology has the potential to cause disruptive changes, oversight is especially important. There is also the potential for destabilisation of the whole field of nanotechnology from such a massive effort. Military research spending should be drastically reduced and proper independent civil oversight provided[6].

I would like to see more SGR activity on nanotechnology issues. In particular, SGR members working in this field could exchange information and ideas on influencing the research agenda to emphasise health, environmental, security or social concerns. If you are interested in discussing this further, please contact me at <alexis.vlandas@materialss.ox.ac.uk>.

Alexis Vlandas is a graduate researcher in nanotechnology at the University of Oxford.

Notes and references

1. My talk was part of the panel session 'Processes required to effectively manage nanotechnology' and is available on request.
2. Royal Society/ Royal Academy of Engineering (2004). Nanoscience and nanotechnologies: opportunities and uncertainties. RS policy document 19/04. http://www.royalsoc.ac.uk/
3. See: International Network of Engineers and Scientists to Protect Ethical Engagement (INESPE); http://www.inesglobal.com/Projects/INESPE/INESPE.html
4. Nanoparticles are particles in which all three dimensions are below 100 nm.
5. Nanotubes are tubular structures where the thickness of the material is below 100 nm. Carbon is currently the most common material used to create nanotubes.
6. Vlandas, A. (2005). Risks of military research in nanotechnology. INES Newsletter, Vol. 48, pp. 1-5. International Network of Engineers and Scientists for global responsibility (INES). http://www.inesglobal.com/