

## **Nanotechnology Briefing Note**

### **What is nanotechnology?**

The 'nano' in nanotechnology refers to a nanometre (nm) which is a millionth of a millimetre. Nanotechnologies involve tiny objects on scales which range from single atoms (which are about 1/5 of a nanometre across) to objects a few hundred atoms across. Materials often behave differently at this scale from the way they behave in bulk quantities, which opens a wide range of new technological opportunities.

### **Applications**

Because of their size, nanomaterials can, for instance, interact directly with proteins on cell walls, which means they offer new opportunities for delivering drugs. Some nanostructures are extremely strong, which means they can be used to create new light-weight materials. Nanostructures, being smaller than the wavelength of light (about 500 nm), can interact with light in novel ways, which may be applied in display technologies or new kinds of dye. The unique properties of nanomaterials may also be used in sensors, in technologies for dealing with pollution, in a new generation of computer chips and many, many other fields.

### **Why now?**

Some nanotechnologies have been with us for a long time. For instance, it is the optical properties of nanoparticles that give stained glass its colour. But working directly at this scale has only become feasible recently as two techniques converge on the nanoscale. From the bottom up: researchers have been able to assemble individual atoms since the 1990s using a technique called scanning tunnelling microscopy. From the top down: microchip technology is now so advanced it can be used to construct objects on the nanoscale.

### **Implications (and dangers)**

Because of the promise of nanotechnologies, nanoscience is attracting a huge amount of investment from both the private sector and government. Nanotechnologies are already significant for this reason. However, they may have much more direct effects on our everyday life very soon. Most of the effects will be positive, but not all. For instance, unequal investment in nanotechnologies globally may be economically destabilising. Military applications are already anticipated (which is either good or a disastrous abuse of human ingenuity, depending on your point of view). For instance, nanomaterials could improve body armour and also armour piercing technology and nanotechnology sensors could be used in missile guidance and 'intelligent' land-mines. There are anticipated environmental and health hazards associated with some nanotechnologies. For instance, the production of some nanomaterials produces toxic by-products and nanoparticles may be toxic if inhaled. But, although there is a lot of research going into these and other environmental implications, because nanotechnologies are so powerful and so novel, there will inevitably be hazards and malign applications that are impossible to anticipate also.

### **What should we be doing?**

Managing the uncertainties and determining who is empowered by nanotechnologies (and who is not) will be a problem for politicians and citizens. These aspects of the technology are not scientific or technical questions. One of the questions Small Talk is asking is whether it will be possible for citizens and politicians to 'set the agenda' or whether we will end up responding to an agenda set by industry.

For more briefing notes see: <http://www.smalltalk.org.uk/page31g.html>