The Ethical Implications of Nanotechnology

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Nanotechnology is predicted to be comparable to the Industrial Revolution in the magnitude of its effect on the modern world. Dr. Richard Smalley, Nobel laureate in chemistry, believes that "'the impact of [nanotechnology] on health, wealth, and the standard of living for people will be at least the equivalent of the combined influences of microelectronics, medical imaging, computer-aided engineering, and man-made polymers in this century.'" Yet in the advent of this nascent technology, we must contemplate the ethical implications of nanotechnology before it is too late to prevent negative consequences or to enhance positive effects.

As with other technologies, it may be predicted that the benefits of nanotechnology will not be spread equally between the rich and the poor, or between developed and third world nations. For example, nanomaterials may be used in water filters to more effectively and efficiently filter pathogens and impurities, yet if these materials are priced too high, it may be too expensive for countries most in need of such technology to utilize it. In another example, medication employing nanotechnology is being developed which may prevent the spread of HIV. Yet has already been seen with other HIV medications, many countries have been unable to afford such treatments. Financial and social inequality will prevent everyone from benefiting equally from nanotechnology. What steps can we take, or should we take, to ensure that those who are most in need receive the benefits of this technology?

Nanotechnology also raises questions about what it means to be human, and what enhancements to our bodies and minds may be ethical. Using nanotechnology to help stroke victims recover or implanting computer chips in the brain to help the blind see and the disabled walk may be tremendous medical breakthroughs. But is it ethical to use the same technology in athletes to boost performance or to allow soldiers to see in the dark? Is it possible to delineate a line between cosmetic enhancement and medical necessity? Who should control what enhancements people can make to their own bodies?

One predicted benefit of nanotechnology is in the area of national defense. The government might be able to develop lightweight nanomaterials for use in body armor to

reduce soldier fatalities and injuries, or even develop nanodevices that could be imbedded in fatigues to dispense antibiotics or pain medication should a soldier be wounded. It is not difficult to conceive of weapons employing nanotechnology that could be used against enemy combatants, perhaps aerosol propelled nanoparticles sent behind enemy lines, or mininuke devices the size of a textbook that could down a building. But can these weapons truly be controlled? What are the effects on civilians, international diplomatic relations, and on future descendents? What would be the consequences should those same lethal weapons fall into enemy hands?

There has been much debate in the last several years of the government's use of different surveillance techniques. Nanotechnology could be used in numerous ways in surveillance, such as in devices that can rapidly scan packages or trucks or even people as they pass by. Tiny nano devices could be implanted in people without their consent to track their movements or monitor their conversations. Should these high tech surveillance devices be used on suspected enemy combatants? Would it change your opinion if such a device prevented a catastrophic event such as 9/11? Should people be asked to give up some rights to privacy if it benefits the greater good? How might nanotechnology be used to violate our right to privacy?

Mini devices could be used to control access to top secret locations or even to regular business offices. There is no chance of misplacing an implanted security device, unlike a regular key. Employers frequently monitor employee internet usage, email, and entry and exit into a building via electronic key card. Can businesses require their employees to accept nano surveillance devices? What would be the effect if employers could track employee movements, even off the company clock? Retailers already use a variety of techniques, such as telephone numbers, and preferred customer programs to track our spending habits. Would it be ethical for a company to hide a nano tracking device in a box of cereal to be able to monitor <u>all</u> our purchases without our knowledge or consent? Should parents implant nanochips into their toddlers to track them in case of abduction? What about into their 16 year old? What would be the effect on society if everyone had to assume they were being watched at all times?

Nanotechnology makes many promises for the future but also raises serious ethical quandaries that will not be easy to solve. But with the promise of the benefits of nanotechnology comes a responsibility to consider these ethical implications.