

## **Widespread hypocrisy about nanotechnology is a worrying sign**

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Having once been invited to talk on nanotechnology by virtue of my position as an ethicist at Monash University, over the last 18 months I have found myself receiving successive invitations to conferences on nanotechnology on the basis of my previous presentations. At these events, I have often found myself placed in the position of a critic of nanotechnology, despite the fact that I have no particular concerns about nanotechnology which are not reflections of more general reservations about the pace and direction of technological “progress”. However, what I *have* become over this period is concerned about the way in which public discussion of nanotechnology is being framed. A not-so-subtle hypocrisy pervades discussion of nanotechnology. Enthusiasts for nanotechnology make one set of claims when they want to advertise and promote this technology and another, often directly opposed, set of claims when sceptics about the technology question their enthusiasm. As a consequence, the terms of the debate about nanotechnology shift so as to hamper substantial critical engagement about the future of this technology.

It may be that nanotechnology raises no distinctive, ethical, political, or environmental issues. However, it is hard to tell when the debate is plagued by constant equivocation between very different claims by those in favour of nanotechnology. What follows then is a list of hypocrisies and contradictions to look out for in discussions of nanotechnology. My hope is that it may serve as a rhetorical “repair kit” for those who wish to think about the issue in a clear and sober fashion.

### ***New technology? Or no technology?***

Scarcely a week goes by that we do not hear something reported in the press about the promise of nanotechnology. Nanotechnology will make possible marvellous new consumer goods which will improve our lives. Nanotechnology will heal the sick. Nanotechnology will be worth so many billions of dollars over the next decade. When researchers and industry spokespeople wish to advertise their products and/or lobby the government for funding, they wax lyrical about the wonders of nanotechnology.

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However, the moment criticism of nanotechnology develops researchers and industry spokespeople beat a hasty retreat to the position that there is no such thing as nanotechnology: there are only nanotechnologies—diverse technologies and techniques for manipulating matter at the nanoscale, which have been developed in the fields of chemistry, physics, engineering, and materials science. Any concerns about “nanotechnology” are therefore misplaced.

I would have more sympathy with this demand for terminological precision if it weren't usually made in conference streams on the ethical, legal, and social impacts of nanotechnology, at conferences with nanotechnology in the title, by critics who have “nanotechnology” on their business cards. It wasn't, after all, critics of nanotechnology who invented the term, which was coined by a scientist and taken up by other scientists in order to attract attention to their work. Moreover, the effect of shifting the topic of discussion to the question of terminology is usually to divert attention from the original criticism into a tedious and remarkably fruitless debate about the appropriate way of referring to nanotechnology—or nanotechnologies—which is then repeated at the next forum on nanotechnology.

Regardless of how we choose to refer to them, those technologies that engineer matter at the nanoscale do potentially raise new hazards and issues as well as hold out new promise. The role played by surface chemistry and quantum effects at the nanoscale means that the products of these technologies can have properties which are not possessed by the same materials manufactured at larger scales. The importance of size at the nanoscale justifies grouping these technologies together for the purpose of further developing and investigating the technologies necessary to manipulate matter at this scale. However, it also justifies grouping them together for more critical purposes.

### ***Revolutionary? Or familiar?***

Perhaps the most common claim made in public discussion of nanotechnology is that it represents a “technological revolution”. Nanotechnology will, we are told, change the world. It will make consumer electronics cheap and widely available. It will provide clean water and plentiful solar power for everyone. It will revolutionise health care. Indeed, if the writings of some nano-enthusiasts are to be believed, there is little that nanotechnology will not do. Describing nanotechnology as revolutionary draws attention to the novelty and/or power of the technology and consequently assists in attracting funding.

The problem with this rhetoric of revolution is that it also draws attention to the magnitude of the changes nanotechnology promises and to the fact that there are likely to be winners and losers from any such revolution. The rhetoric of revolution also draws attention to the questions of power and democracy involved in technology policy. If there is to be a revolution, it should be a democratic one. Indeed, given that revolutions are dangerous and unsettling, perhaps we don't want a revolution at all!

When questions about the distribution of benefits of this purported revolution or about who will control it arise, then, enthusiasts for nanotechnology retreat to the contrary claim that nanotechnology is nothing new, that it is in fact entirely familiar. Nanotechnology is merely the latest stage of a continuing process of miniaturisation of technology. Indeed, it is already present in various consumer goods such as paints, sunscreens, and some consumer electronics. Because the technology is familiar, we have nothing to fear from it. We might equally wonder what all the fuss is about and whether the promise of "more of the same" justifies the enormous amount of public money currently being spent on nanotechnology research.

Cynics might note at this point that it is when researchers and corporations want to patent their products that they argue that they are new and unique. However, when it comes to discussing their possible effects on human health and environment all of a sudden they argue that these nano-products are nothing new.

The question of whether nanotechnology is revolutionary or familiar is perhaps most important when it comes to evaluating the possible environmental and health impacts of nanoparticles, as the use of engineered nanoparticles for their catalytic or other properties in manufacturing is the nanotechnology which is closest to fruition. In discussions about this topic, it is often pointed out that we are all already regularly exposed to nanoparticles in the form of the exhaust products from diesel combustion engines, soot from forest fires, and salt in sea air. Exposure to nanoparticles is nothing new and—by implication—nothing to fear. What this observation neglects (besides, bizarrely, the fact that some of these particles are known to be responsible for thousands of deaths each year in modern cities) is that the nanoparticles that have been produced by human activity to this point have been accidental products with large distributions of particle size and shape. Engineered nanoparticles will have uniform distributions and particular structures. They are therefore likely to behave very differently.

## ***Inevitable? Or precarious?***

According to many pundits, the nanotechnological revolution is not only going to change the world, it is going to do so regardless of what you or I think about it. Many writers on nanotechnology seem to feel that technological development has its own dynamic which is effectively beyond human control. As a result, the development of nanotechnology is, we are told, inevitable. The future is coming and we had better get ready for it.

Yet this certainty that the development of nanotechnology is inevitable seems to be matched by hysteria at the possibility that public hostility to this technology, lack of investment, or a hostile regulatory environment, might prevent it. Indeed, it sometimes seems that the main function of the claim that the development of nanotechnology is inevitable is to support the argument that we must get ready for it. Unless we direct more money into funding this technology, change our intellectual property law, and educate the public about the benefits of nanotechnology, the nanotechnology revolution will not arrive. Of particular note in this context is the frequency with which consumer hostility to GMOs is mentioned in discussions on nanotechnology as an example of the way in which public concerns about safety and benefit can remove the incentive to develop certain types of product and thus effectively halt the development of a technology. Those involved with developing and promoting nanotechnology are terribly concerned to avoid any similar public backlash against nanotechnology. Of course, the possibility that the public might reject nanotechnology suggests that the nanotechnological revolution is not inevitable after all.

## ***Nothing to be afraid of? Or cause for alarm?***

The next contradiction I wish to draw attention to does not appear in public discussions of nanotechnology so much as between the rhetoric and the reality of the regulatory authorities that are likely to be responsible for protecting consumers and the environment from any hazards associated with nanotechnology.

One of the “big questions” in current discussions of nanotechnology is whether the public is adequately protected from possible hazards associated with exposure to nanotechnology. In order to establish the need for extensions to existing regulations, critics and concerned regulators emphasise our current lack of knowledge about the toxicity or safety of matter engineered at the nanoscale and the gaps in our existing regulatory schemas which mean that materials that are “new” only in relation to their size are unlikely to be subject to any special scrutiny. In my

experience, these presentations make a convincing case that the public is currently not adequately protected from possible hazards due to nanoparticles. At the very least, our existing regulatory systems need to be strengthened and modified to ensure that nanoscale particles and materials are evaluated for their safety and possible environmental impacts before being released into the environment. The fact that the properties of nanomaterials—and of engineered nanoparticles in particular—are so sensitive to their size, shape, and molecular structure suggests that this may be more difficult than first appears.

However, the presentations which set out the need for the extension of existing regulatory systems are striking not just because of what they conclude about the unknown risks involved in nanotechnology but because of what they reveal about our regulators' attitudes towards environmental risks more generally. Having heard that the toxicology of nanoparticles is largely unknown, that the data which does exist suggests that they may well be much more toxic than bulk materials of the same substance, that they may bio-accumulate, that some nanoparticles seem to be able to pass through the skin while others seem to move directly to the brain, and finally, that cosmetics containing engineered nanoparticles are already on the market, I naively expect to hear expressions of outrage that the public is being exposed to these potentially toxic materials. It seems simple common sense to me that until it can be established that these materials pose no threat, products containing engineered nanoparticles should not be released on to the market or into the environment. Instead, it becomes abundantly clear that many toxicologists, industry figures, and regulators feel that there is nothing untoward in the public being exposed to such risks. Those involved in regulating chemicals and other possible hazards are well aware that we are all regularly exposed to a myriad of chemicals the safety of which has never been established; as a result the situation concerning nanotechnology does not—in their minds, at least—cry out for attention.

Existing regulatory systems for environmental protection and health and safety regulation of chemicals turn out to be remarkably unimpressive from the perspective of a concerned citizen. To a large extent, these regulatory systems rely on manufacturers self-regulating and providing data on the chemicals they manufacture and/or import to the relevant regulator. Regulatory agencies are often over-worked, under-staffed, under-funded, and have limited power to investigate and/or punish breaches of the law. It is striking how conservative governments who describe themselves as “tough on crime” leave corporate individuals to regulate themselves! Hearing that nanotechnology will be regulated in line with existing frameworks therefore does

not fill me with confidence.

### ***Ethical issues? What ethical issues?***

Studies of the ethical, legal, and social issues raised by nanotechnology often conclude by suggesting that nanotechnology “raises many ethical issues”. This follows naturally from treating nanotechnology as a revolutionary new technology. It also reflects the tendency in the literature to discuss nanotechnology as though it were a successor to the biotechnology and information revolutions, which clearly have raised many new ethical issues.

My own experience is that it is in fact difficult to identify any genuinely *new* ethical issues raised by those nanotechnologies that are likely to be developed in the short-to-medium-term future. The most urgent ethical issues associated with nanotechnology concern the relationship between democracy and technology, respect for the environment, risk, privacy, social justice, and the possibility of arms races. All of these issues are already familiar to us as a consequence of existing technologies.

However, my concern here is not with the accuracy of the claim that nanotechnology raises new ethical issues but with the apparent ease with which it sits beside the assumption that we should embrace nanotechnology. If those developing nanotechnology really believe that it raises so many ethical issues, you would think that this would at least lead them to adopt attitudes of humility and caution regarding this technology. Yet these attitudes are noticeably absent from most discussions of nanotechnology.

Indeed, the idea that the development of nanotechnology is inevitable sometimes produces a shocking and flagrant disregard for the possibility that certain applications of nanotechnology might be unethical. If the development of the technology is inevitable, any negative impacts are equally unavoidable. The only question left is who will profit from this state of affairs; the clear implication is that Australia should ensure that we get our share of the spoils. This argument, of course, also works for the production of opium, selling arms to terrorists, and building weapons of mass destruction. The fact that others are doing, or are likely to do, something wrong, is not itself a compelling reason for us to join them.

In the absence of an acknowledgement of a real possibility that we might choose not to develop nanotechnologies, it is easy to suspect that these gestures towards “ethical issues” are intended mainly as an advertisement that industry and government are appropriately concerned. A

genuine concern for ethical issues would, though, result in less haste in pursuing the profits associated with developing a nanotechnology industry and more reflection and debate on how (and whether!) to proceed.

## **Conclusion**

A proper critical assessment of the impacts, costs, and benefits of the adoption of nanotechnology will not be possible until we can clear away some of the hype around it and adjudicate between the competing claims made on its behalf. If there are only different nanotechnologies, if they are already familiar to us, if we have a choice as to whether to develop them, and if they are adequately regulated by existing institutions or something like them, then there may well be nothing to be afraid of and no significant ethical issues that we need to resolve. If, alternatively, nanotechnology is a revolutionary new technology, the development of which appears to be inevitable, and which raises profound challenges to our regulatory systems as well as new ethical issues, then we would do well to proceed cautiously, if at all. Working out which of the very different claims made about nanotechnology are true is therefore essential if we're to be able to make informed decisions about it.

However, the real problem arising from the existence of the contradictory claims I have highlighted is not so much that it is hard to work out which of them is true but that the combination of them functions to close down the space in which critical engagement with them might take place. Changing stories allows nano-enthusiasts to avoid having to discuss the full implications of their original claims. When advocates for nanotechnology want to drum up interest in it, or funding for it, they talk about nanotechnology and argue that it is revolutionary; when they want to defuse fears, they insist there are only nanotechnologies which are already familiar. When they want the public to accept nanotechnology they argue it is inevitable; when they want the government to provide more funding, change the laws, or educate the public to be more enthusiastic about it, they argue it is precarious. They allow that nanotechnology requires regulation but ignore the problems with the institutions that will be doing the regulating. While they routinely acknowledge the importance of ethical issues, they seldom acknowledge the possibility that these might constitute a reason to turn away from developing nanotechnology. This pattern of claims reflects an attempt by advocates for nanotechnology to have the best of both worlds across these areas. It also functions to continually defer sustained ethical discussion of any of them.

As billions of dollars of public money are poured into nanotechnology research and as the products of nanotechnologies start to be introduced to unwitting consumers and to the environment, we can ill afford to defer discussion of the issues raised by nanotechnology any longer. It is time to hold all those involved in debates about nanotechnology to the claims they make and to highlight and condemn hypocrisy of the sorts I have identified here. If enthusiasts for nanotechnology try to change their stories when critics respond to their original claims, we should recognize this as a sign that they are more concerned about getting the public to embrace nanotechnology than they are about participating in a genuine debate about it. Yet a genuine, open and vigorous debate is precisely what is required if we want to continue to claim to be a democratic society while pursuing a technology with potentially widespread and profound social and environmental consequences. My hope is that this essay will help concerned individuals and organisations generate and participate in such a debate by identifying and responding to the hypocrisy which currently bedevils discussions of nanotechnology.<sup>1</sup>

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