

Allhoff, Fritz, Patrick Lin, and Daniel Moore. 2010. *What is nanotechnology and why does it matter? From science to ethics*

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What is nanotechnology and why does it matter? These are two questions examined in a recent book by two philosophers, Fritz Allhoff and Patrick Lin, and one nanotechnologist, Daniel Moore. The vast majority of the public is not prepared to answer these questions, and this book is designed to help in that regard. The first section of the book introduces readers to nanotechnology and its applications; the second reviews issues associated with risk, regulation, and fairness; and the third describes applications in several sectors and discusses their social and ethical implications. The book ends with a recap of the twelve chapters in sections I through III and a few pages of general conclusions.

Nanotechnology involves the engineering of matter at the nanoscale, approximately the size of a few atoms or molecules. It has been described as the next technological revolution, poised to change manufacturing, consumer products, electronics, medicine, health care, energy, and more. The ground-breaking capabilities, special properties, and widespread uses of engineered nanomaterials have engendered concern about their safety and societal implications.

The authors state that the purpose of the book is to “tame the riot of speculation with an informed and balanced look at nanotechnology and its issues” (ix). On the whole, the book does try to strike a balance, but there are some troubling spots. Conclusions in several of the chapters take a particular point of view, and non-expert readers looking for guidance should be wary of accepting them at face value. As such, this review focuses on instances of imbalance.

Section I includes chapters on the basic definitions, concepts, and tools associated with nanotechnology. These chapters are peppered with histories of nanotechnology development and fundamental scientific discoveries about matter. These stories make for interesting reading as the authors draw connections between key findings from centuries ago to present-day nanotechnology. The text is generally easy to read with the exception of the sometimes-too-technical explanations of physical chemistry and its equations, which seem out of place. Chapter 4 does a particularly good job of explaining the scientific foundations of current-day and potential future applications of nanotechnology. It moves from mundane applications, like better tennis balls and stain-proof pants, to nanobots that cure disease. It makes the argument that today’s consumer applications (note: there are currently about 1,000 on the market) will pave the way for more important societal contributions from nanotechnology. However, the authors do not discuss the path needed to get there. Social and ethical issues

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associated with science and technology funding and drivers for technological development are not addressed. More discussion about how to catalyze life- and environment-saving applications of nanotechnology would be needed to support their argument that nanotechnology is bound to contribute more positively to society. So far, the vast majority of nanoproducts have been targeted toward profit-rich areas such as consumer electronics, cosmetics, and dietary supplements.

Section II examines conceptions of risk, regulation, and fairness. The first chapter in section II focuses on uncertainty and precaution. The authors evaluate the precautionary principle as one approach to dealing with risk and uncertainty. In doing so, they pick an example of this principle, which depends on: 1) catastrophic outcomes; 2) only a small possibility of harm; and 3) bans as the remedy to prevent the harm. With this extreme version of the principle, they argue generally against precaution as a first approach to dealing with nanotechnology risk and regulation. Their broad conclusions do not seem valid given their narrow starting point.

Another seemingly invalid statement is that defenders of the precautionary principle focus too much on “burdens of proof” and that “the risks are what matter, not where the burdens of proof fall” (93). It is not clear why they reach this conclusion. The responsibilities of various sectors, such as industry and government, to demonstrate safety or risk raise important regulatory policy questions with significant ethical and social implications. Bias, conflict of interest, ownership of data and information, and equitable risk/benefit distribution are intertwined with “burdens of proof” for addressing nanotechnology safety. Overall, in this section, risk, uncertainty, and precaution seem divorced from important ethical and social issues associated with responsibility, beneficence, integrity, and informed choice. A more general criticism of the book is that it artificially divides categories of issues, such as regulatory policy and ethical principles (for example, risk assessment and informed choice), without making efforts to understand and illustrate their connections (see Kuzma and Besley 2008).

The next chapter in section II looks at different regulatory options, such as stricter laws or industry self-regulation. The authors argue that embracing a stricter law approach for nanotechnology does not

presently seem justified, although they do not rule it out for the future. Instead, the authors suggest a “plan B” that includes more testing and environmental health and safety research while industry self-regulates. They state “if we can improve testing methods, then we may not need new laws or stronger regulations, at least in the meantime” (122). The justification for this claim is not clear. Testing is a complement, not a substitute for regulation. The results of tests cannot directly tell you what to do about a product or application, and societal decisions still need to be made about whether to allow, prohibit, or control the application based on the results. These fall in the realm of governance, oversight, and regulation. In addition, the potential harms of waiting for more research are not discussed as an ethical issue in this chapter.

The authors continue to describe their proposed regulatory approach as follows: “It agrees that more regulations are needed, but holds that the nanotechnology industry should be the one to create and implement them, since the industry knows nanotechnology best and has a direct interest in sustaining the field” (123). They suggest EPA’s recent Nanoscale Material Voluntary Stewardship Program as a good example. However, theoretical and demonstrated problems with this approach (supported by literature on public attitudes and trust, bias, and conflicts of interest and the failure of EPA’s program to engage industry) are not presented. Overall, the support for the authors’ “plan B” is weak.

The third chapter in section II intends to cover issues of fairness. It emphasizes the developing world’s need to acquire the benefits of nanotechnology, such as for water purification, and developed countries’ obligations to ensure access to nanotechnology innovations. The chapter does a good job of tying philosophies of the past, such as the idea of “proportionality” of Aristotle and John Rawls’ Theory of Justice, to these issues. However, fairness is not discussed in a broader context (for example, associated with risk and regulation or intellectual property protection). This chapter provides only a narrow look at fairness from the standpoint of promoting nanotechnology worldwide.

Section III of the book walks through various applications of nanotechnology and their associated ethical and societal issues. It takes a promotional view on technology development. For example, when

discussing nanotechnology and the environment, the authors conclude that their goal has been “to offer some possible frameworks for assessing and proceeding with developing new technologies” (169). The option of *not proceeding* with nanotechnology applications is not given serious attention. Most of the chapter is devoted to the benefits of nanotechnology for solving environmental problems. Risks from the use of nanomaterials in the environment are given only passing mention, although prominent scientific groups have expressed concern about these applications (Royal Society 2004).

Other chapters in section III also endorse a promotional perspective. For example, when discussing small tracking and detection devices that incorporate nanotechnology (e.g., radio-frequency identification devices or RFIDs), the authors conclude that “RFID is not likely to be a huge imposition on privacy” (214). They argue that encryption or authorization technology can mitigate privacy concerns, encouraging further technological fixes for problems associated with the use of nanotechnology. They also state that they do not support regulation for RFIDs. Although the authors might ultimately be correct, it is too soon to predict the impact of nano-RFIDs on privacy. Recent experiences with information technology and privacy—for example, Google—(see Bilton 2010) seem to refute the authors’ dismissal of these concerns. Oddly, they further justify their view by arguing that there are more pressing problems in the world to worry about than privacy issues, like people dying from lack of access to clean water. The human enhancement chapter is perhaps the most balanced in this section, calling for a closer look at the various applications and the likely need to regulate some on ethical grounds.

In the last few pages of the book (258–260), the authors successfully strike a balance. They finally

take up key, underlying problems associated with nanotechnology in society such as the disconnect between drivers for nanotechnology research and development and promoting social good, the need to thoroughly examine the ethics and efficacy of different regulatory approaches, pervasive patenting that may stifle innovation particularly for the poor, and the lack of global dialogues which engage diverse experts, stakeholders, and citizens. One wishes they would have gotten to these discussions much earlier in the book. A key ethical issue is whether non-experts should have a say in decision-making about what nanotechnology products and applications are used and how they are overseen. The book does not address the growing call for public participation and engagement in decision-making about emerging technologies in order to increase legitimacy, ensure that interested and affected parties have a voice, and improve policies and outcomes (see NRC 1996; Wilsdon and Willis 2004). However, for the reader looking for general background about nanotechnology and many of its social and ethical issues, the book is worth reading, as long as its arguments are carefully scrutinized and increased understanding of connections among such issues is not expected.

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