Book Reviews

NANOTECHNOLOGY & SOCIETY: A GLOBAL DEBATE ON "NANOETHICS"

Fritz Allhoff, Patrick Lin, James Moor, John Weckert (eds.): *Nanoethics. The ethical and social implications of nanotechnology*. Hoboken/NJ: Wiley, 2007, xxiv+385 pp. [ISBN: 978-0-470-08417-5]

Henk A.M.J. ten Have (ed.): *Nanotechnologies, Ethics and Politics*. Paris: UNESCO Publishing, 2007, 244 pp. [ISBN: 978-92-3-104051-1]

In view of the revolutionary potentials frequently attributed to nanosciences and nanotechnologies with respect to nearly all fields of society and the individual life, it is not surprising that "nano" has found great interest in the media and in the public. In parallel to high expectations, e.g. in the fields of health, growth, and sustainable development, there are concerns about possible risks and side-effects. Analyzing, deliberating, and assessing expectable impacts of nanotechnology on future society are regarded necessary parts of the present and future development. Research and reflection on nanotechnology & society has emerged since the beginning of the decade and led already to the notion of a "nanoethics". It mostly takes place in commissions and expert groups, projects of technology assessment, and in STS-studies at dedicated sessions of conferences and workshops and in the form of edited books.

Recently, two further books in the context of "nanoethics" have been published which are subject to this review. Common to them is first a broad understanding of ethics, in considerable distance to a "continental" understanding where ethics is traditionally regarded a sub-discipline of philosophy dealing with normative issues. Both books include chapters on many different issues in the broader context of "nanotechnology & society", but excluding the economic dimension. Ethical analysis in the narrower "continental" sense, however, is hard to be found in both books. Their second common feature is that the authors cover a wide range of expertise and institutional backgrounds. However, in the anthology by Fritz Allhoff et al. the U.S. perspective on nanotechnology & society strongly dominates, whereas the book edited by Henk ten Have has tried to find a global balance in terms of the geographical distribution of the authors.

According to the publisher's advertisement, *Nanoethics* (ed. by Fritz Allhoff et al.) claims to be not simply an edited volume as others but an *anthology*. In fact, already a glance on its table of contents shows that the entire field of nanotechnology & society (except the economic dimension) is covered to a large extent. The book is divided into seven parts, each of them including three to four chapters and – what is indeed a reader-friendly advantage – a thematic introduction by one of the editors. In the following I will discuss only some of the main issues included, because it is impossible in this review to address in detail all of the 26 papers written by about 40 authors.

The first part serves as an overall introduction to the field and starts with an approach to define nanoscience and nanoethics. Patrick Lin and Fritz Allhoff, members of the editorial team, argue that nanoethics as an own subdiscipline deserves attention by applying an

extremely broad understanding of "ethics": "nanoethics means something like the ethical, social, environmental, medical, political, economic, legal issues, and so on, arising from nanotechnology" (p. 10f.). In this way, "nanoethics" serves as an umbrella term to combine many different issues in the field of nanotechnology & society. The first part also includes the famous paper by Bill Joy "Why the Future Doesn't Need Us" as well as an analysis of the U.S. Congress policy on societal implications of nanotechnology, authored by futurist writer Ray Kurzweil.

The second part is dedicated to the background of the public nanotech debate, which is characterized by high expectations in nanotechnology to overcome humanity's pressing challenges (authored by Christine Peterson and Jacob Heller working with Eric Drexler). In a more modest version, the same conviction also appears behind the U.S. National Nanotechnology Initiative (as described by Neal Lane and Thomas Kalil) and has led to the necessity of debating societal implications of nanotechnology (Richard A.L. Jones).

The third part (with chapters by Charles Tahan, Nick Bostrom, Jean-Pierre Dupuy, John Weckert, and James Moor) deals with the revolutionary aspects of nanotechnology. It includes techno-optimistic papers pointing to the benefits of nanotechnology as revolution as well as critical papers that consider the Precautionary Principle and other precautionary ways of dealing with "revolutionary" developments. As its main message, this part illustrates that there are extremely different approaches and conclusions to nanotechnology "as revolution".

In the fourth part the volume partially comes closer "down to Earth" by addressing EHS (environmental, health, and safety) problems of nanotechnology. Anne I. Myhr and Roy A. Dalmo present an analysis for identifying those nanotech issues that could and should be interpreted and managed as risks, primarily with respect to human health and the environment, using patterns from the sociology of uncertainty. Robert A. Freitas jr. addresses challenges of personal choice in emerging nanomedicines, while the chapter by David Guston et al. discusses human enhancement in the context of governance and democracy. However, by posing the question if we are playing God with nano-enhancement, Ted Peters turns to again to a very different level.

Guston's chapter connects to the fifth part dedicated to democracy and policy issues. James J. Hughes, one of the leading transhumanists, takes up nanotechnology threats like grey goo, killer robots, and new bio-weapons and proposes establishing global technology regulation regimes to deal with such threats. The other chapters (by Colin Farrely, David M. Berube and Jack Stilgoe/James Wilsdon) deal with different forms of engagement and deliberation from a stakeholder's perspective.

Part six on "Broader Societal Impact" addresses classical questions in the field of nanotechnology & society: the privacy issue, building on the RFID case (Jeroen van den Hoven), the challenge of military applications of nanotechnology (Daniel Moore), educational issues (Patricia Schank et al.), and the impact of nanotechnologies on developing countries (Joachim Schummer).

The final part is, not surprisingly, dedicated to the "distant future". Mike Treder and Chris Phoenix give insights into the upcoming debate on "exponential manufacturing" which shall be based on molecular nanotechnology and shall enable "personal nanofactories" which could revolutionize traditional manufacturing. Tihamer Todt-Fejel and Christopher Dodworth discuss the use of nanotechnology for space travel and space settlement. J. Storrs Hall thinks about an ethics for artificial intellects and Sebastian Sethe about life extension. In this way the debate comes back to the starting point of the volume, the high visions related to nanotechnology.

Summarizing my impressions, the claim of offering an anthology of nanoethics seems to be justified to a considerable extent, particularly with regard to the range of issues included. Although the range of authors is wide, it is not fully representative of the field. The predominance of Anglo-American thinking as well as the strong presence – seen with European eyes – of authors from the techno-optimistic and futuristic direction limit the representative status. This point, however, does not influence an overwhelming positive impression. The volume integrates large parts of the state of the art reached in the context of nanoethics and addresses perspectives for future work.

In 1998 UNESCO founded a commission to deal with emerging ethical questions at the global level, the World Commission on the Ethics of Scientific Knowledge and Technology (COMEST). Its mandate is to be an intellectual forum for the exchange of ideas and experience, to detect early signs of risk situations, to advise decision-makers and to promote dialogue between science, policy-makers, and the public. COMEST established an ad-hoc group to study and analyze ethical aspects of nanotechnology. More specific, the group should address two questions: (a) what is the state of the art of nanotechnology and what are the ethical issues related to it? (b) What opportunities are there for international action regarding these issues? The book edited by Henk ten Have gives the answers given by the expert group.

The editor's introduction provides an overview of the history and mission of COMEST. Several pages are dedicated to the conceptual question of why – in ten Have's view – Technology Assessment (TA) was not able to appropriately deal with ethical questions of emerging technologies (pp. 24ff.), which led to the necessity of establishing activities specifically designed to address ethical question. This view, however, refers to a debate in the 1990s. Today, there is no longer a sharp borderline between TA and ethics of technology.

According to the questions to be tackled, the first part of the book is dedicated to the state of the art of nanotechnology. The first chapter (by Margreth S. Andrade) addresses aspects of the evolution of nanotechnologies so far. The author presents a quick guide through the emergence and history of nanotechnology and focuses on its transdisciplinary character as well as on the changing role of scientists. The second chapter (by Jixing Liu) describes the state of the art of nanotechnology reached today in a rather detailed and informative way. Interestingly, and this shows the global perspective of the book, both chapters in this first part mention the role of nanotechnology for developing countries, although there is also an own chapter dedicated to that issue.

The second part is headed "Ethical Issues". Building on an analysis of the problem to define nanotechnology, Joachim Schummer provides an overview of ethical issues of nanotechnology. The classification of ethical issue is in accordance with other explorations of the field which have been developed in the last years. The author concludes with recommendations for regulation and for further research as well. Bert Gordijn addresses the more specific case of nanomedicines and distinguishes between short-term, medium-term, and long-term ethical issues. More general, Donald Evans approaches the broad field of nanotechnology and (public) health, also beyond nanomedicines, including considerations of patient care and clinical innovations. The author concludes that early stakeholder involvement will be necessary to prevent undesirable developments and to harvest the promised benefits.

The third and last part focuses on policy issues in the context of UNESCO as a global organization. Erin B. Court et al. analyze the (frequently

discussed) impact of nanotechnologies on developing countries. As the main targets for the use of nanotechnologies in developing countries, they identify renewable energy sources, promoting health, reducing hunger, and improving water and sanitation. Their consideration of what such countries are doing in nanotech is restricted to countries quickly catching up with industrialized countries, like China and India. The authors conclude with recommendations of how industrialized countries could assist developing ones in harnessing nanotech benefits. The chapter on public engagement and education for ethics in nanotechnology is authored by Kyunghee Choi. A more conceptual chapter by Michéle S. Jean et al. reports on activities of the Quebec Commission on Ethics in Science and Technology. Their focus is on early assessment and policy-making including participatory measures.

In sum, this volume provides a good overview about the field, focusing more on policy issues than on ethical ones. The national range of authors is broader than that of the *Nanoethics* anthology reviewed above. Though there is considerable overlap between both books with regard to the issues dealt with, they are more complementary to each other because of the different perspectives of the editors and the respective missions, histories, and ideas behind them.

Taking both books into consideration, it seems that a first stage of dealing with issues of nanotechnology & society has come to an end. This stage began around 2001 with irritations: while nanotechnology had before been perceived as an exclusively positive development, a clean and smart technology providing far-reaching opportunities for welfare and progress in many respects up to the beginning of this decade, suddenly negative and possibly dark sides of nanotechnology were debated. The more fantastic stories about threats resulting from nanotechnology changed the situation dramatically, like the grey-goo scenario or the scenario of humans making themselves superfluous by nanotechnologies and converging technologies, but also early warnings about possible environmental and health hazards of nanoparticles. The first years of ethical analyses of nanotechnologies and their societal impacts aimed at pointing out the necessity of nanoethics, structuring the field, identifying ethical issues, and thinking about the status of nanoethics in the overall system of ELSI-studies (ethical, legal, social implications), Applied Ethics, and Technology Assessment. This stage of exploring the field is, according to my observation, close to be finalized. The set of ethical questions of nanotechnology is now more or less consolidated, building on the work of the last years. This set has become canonical as a synopsis of the recent approaches shows, which is supported by the two books reviewed here. These books may thus be regarded as a summary of the debates and explorations of the last years.

Nanotechnology has been an umbrella term for many years. Nowadays, however, the diversity covered by this term increases further and has reached such an extent that the umbrella function of the term "nanotechnology" becomes more and more difficult to maintain. The situation is similar with the term "nanoethics". It covers a large range of very heterogeneous issues, actors, challenges, fields of reflection, and disciplines involved. Both terms could loose their umbrella function in the next years. The increasing use of the plural "nanotechnologies" instead of the singular "nanotechnology" could be an indication of a coming dissolution of "nanotechnology" into its diverse subfields, and of nanoethics in parallel.

At the level of aggregation chosen in both books under review – the general level of "nanotechnology & society" – almost everything has been said; and in the meantime it seems that it has also been said by everybody engaged in the

field. In this sense, the state of the art reached in the two books should be the point of departure for more concrete, more detailed work, closer to applications and products – and more differentiated.

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