Techno-Futures

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While the last two issues of *NanoEthics: Studies of New and Emerging Technologies* each included a special section, the present issue is comprised of articles that, taken together, mirror much of the journal's broad thematic scope.

Of course, as a leading, interdisciplinary medium for research on a wide variety of aspects of nanoscience and nanotechnologies, *NanoEthics* always aspires to inform its readers about some of the best new work being done in this field. In their contribution to this issue, Nidhi Gupta, Arnout R. H. Fischer and Lynn J. Frewer present the results of their empirical research into the common ground and differences between the views that consumers and experts have concerning different applications of nanotechnology. They argue that the processes by which these applications are commercialized will be driven by expert, rather than lay, opinions about what is societally acceptable, while the final outcomes of these processes will depend on lay responses to the technology. Among many other things, the authors point out that consumers are hesitant to support the use of nanotechnology in areas of application such as sports goods and cosmetics, but are largely in favour of nanotechnology applications in such vital areas as medicine and food products. The results of their research also suggest that

consumers are strongly driven by ethical concerns, such as doubt and uncertainty about whether the benefits of nanotechnology applications will be distributed equitably. Experts, meanwhile, often appear to believe that consumers will be highly concerned about physical contact with nanomaterials, but the study carried out by Gupta and her colleagues does not confirm this belief. As one interpretation of these results, the authors suggest that although experts are aware of the importance of societal acceptance and try to identify the potential drivers of societal responses, they nonetheless tend to focus on the technical issues associated with applications of nanotechnology. Read against the backdrop of other pertinent literature [1–3], the study supports the impression that, while still marked by relatively low degrees of actual knowledge about the field, public perceptions of nanotechnology applications are maturing and becoming more differentiated as time goes by, something that is happening in parallel with the maturing of the field itself. In her article for this issue, Emily York reports on the results of ethnographic research that she has conducted into a 'technical' education course at a department of nanoengineering. Focusing on the notion of 'smaller is better', which was of central importance to this course, York argues that the course led to the production of a particular ethos and worldview shaped by this overly abstract, universal notion. From her point of view, embracing a more reflexive engagement with the implications of going smaller would still allow for promissory visioning, but would demand that it be coupled with robust visioning of what lies beyond such promises. Rather than

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focussing on the notion that ‘smaller is better’, she proposes that the emphasis be placed on context, specificity and an open-ended, democratic approach to technoscientific production, asking when, how and for whom smaller might be better.

Also looking at nanotechnology, but discussing broader technology governance aspects—which are a major concern for this journal—Karena Hester, Martin Mullins, Finbarr Murphy and Syed A. M. Tofail present an approach to nanotechnology governance which is based on anticipatory ethics and governance, future-oriented responsibility, upstream public engagement and theories of justice. This approach, which they have christened ‘anticipatory ethics and governance’ (AEG), is explored in their article through a discussion of several important established approaches to the governance of nanotechnology, as well as other new and emerging technologies. Guided by Rawlsian theory, in which procedural justice is the vehicle by which an approach based on distributive justice is the output, they argue for the usefulness of a methodology that is able to provide fair terms of social co-operation on the basis of mutual respect and trust which ‘the public’ might reasonably be expected to endorse. They argue for what they call ‘traditional top-down command and control type models of governance’ to be replaced with a space for theoretically informed dialogue among a diverse range of stakeholders who have divergent values and desire different outcomes. From their perspective, this could give rise to a comprehensive ‘future care orientation’ in the governance of nanotechnology. In her article, Ineke Malsch examines the mainly North-American communitarian criticism of political liberalism and the related, mainly European concept of subsidiarity in order to shed new light on international discourse about responsible innovation. After selecting some relevant aspects of a communitarian-subsidiarity model for a dialogue society, she proposes an analytical framework and applies it to recent international discourse on responsible governance of nanotechnology. As one outcome of the analysis, indicators for monitoring progress in responsible global innovation are suggested. Malsch emphasises that the communitarian perspective, coupled with the concept of subsidiarity, can give rise to a significantly different view on the societal dynamics influencing the emergence of new technologies than liberal social contract thinking, bringing to light political and ethical aspects of the issues on the international agenda on responsible governance of emerging technologies, in

addition to more traditional technical aspects. The article by Karinne Ludlow, Diana M. Bowman, Jake Gatof and Michael G. Bennett, which draws on the experiences of one jurisdiction (Australia), discusses the regulation of new and emerging fields such as nanotechnology, biotechnology and synthetic biology. They argue that the following factors are particularly relevant to the assessment of future changes in the Australian regulatory frameworks for emerging technologies: the timing of horizon-scanning and monitoring activities for the identification of emerging technologies and their outputs, the availability of the data regulators required for this purpose, reviews to determine whether the definitional boundaries laid down in regulatory frameworks match emerging technology developments, the capacities for and definition of roles in the identification, assessment and management of potential risks and their magnitude and the conduct of stakeholder engagement processes to determine desired regulatory responses. Ludlow and her colleagues stress that, instead of picking out just one or a few of these factors, what is needed is a careful balancing of all the key factors in an approach which takes account of the specific characteristics of the new or emerging field in question. Their study can thus be read as a plea to overcome the lamentably fragmentary character of current science and technology governance, under which ‘classical’ regulatory measures, the production and dissemination of knowledge relevant to regulatory questions and the boom in participatory activities far too often occupy parallel spaces and do not inform each other.

In his thought-provoking and beautiful article on what he terms the ‘chronopolitics of prevention and preemption’, Mario Kaiser draws on a wide variety of sources, including philosophical works, popular films and statements by politicians and representatives of civil society, to shed light on how we deal in the present with potential future challenges, potentially catastrophic ones in particular. His study is testament to our journal’s ambition to not only provide our readers with important contributions to science and technology governance research in a narrow sense but also with analyses which place this kind of research in broader, philosophical, cultural and other contexts. Since the 1990s, we have witnessed, not just in connection with nanotechnology [4], an increased preoccupation with the general dynamics of ‘visioneering’ on the part of science and technology studies (STS) scholars, including technology assessment (TA) practitioners (cf. [5]) and, more broadly,

‘socio-technical imaginaries’ (Sheila Jasanoff). Against the backdrop of the parallel rise of (techno-) ‘visionary marketing’ [6] and the massive amount of institutionally sponsored civic deliberation on technoscientific futures, it has become obvious that recent discourse on science, technology and the future has suffered from historical short-sightedness and a large degree of ignorance about the cultural context of science and technology governance. Kaiser’s piece can be seen as an antidote to the poisonous effects of the breathless evocation of all kinds of blissful or catastrophic futures. In this context, he advocates that a distinction be drawn between two contrasting ways that we deal with the future: the chronopolitics of prevention and the chronopolitics of preemption. As he sees the matter, the chronopolitics of prevention have at their core a striving for the normalization and conservation of the present in the face of dangerous futures. By contrast, the new chronopolitics of preemption are geared towards a reformation, if not even a revolution of the present. Taking the debates on human embryonic stem cells and nanotechnology as his examples, Kaiser closely analyses and compares these two attitudes towards the future. Ultimately, he argues, we may ask if preemptive chronopolitics are compatible with democratic procedures and processes because democratic governance requires time, something that is a scarce resource under the regime of preemption.

As readers of *NanoEthics*, you will most probably be aware that the field of synthetic biology has been discussed in this journal for quite some time now (e.g. [7]). We expect many more contributions on this topic to be published in *NanoEthics* in the future. While it may legitimately be asked whether the excitement about the notion of ‘synthetic biology’ obfuscates the fact that this supposedly emerging field is the product of advances in genetic engineering and the life sciences, it would be tantamount to a denial of reality if we were to dismiss the ethical and societal relevance of the technoscientific developments discussed under this heading. Of late, we have not only witnessed significant technological progress, such as the rapidly increasing use of the gene-editing technique CRISPR-Cas9 (CRISPR associated protein 9), but the breaking of a taboo: the genetic modification of human embryos, which was recently done in China. In this context, leading researchers have argued that the scientific community should impose a voluntary moratorium on genome editing in germ cells, expressing their concern that even

permitting germ line modification for unambiguously therapeutic interventions could set us on a path towards non-therapeutic genetic enhancement [8]. These developments have taken place against the backdrop of massive hyperbole about synthetic biology and numerous exercises in techno-visionary marketing, some of them radically transhumanist (e.g. [9]). In their contribution to the present issue of *NanoEthics*, Anna Deplazes-Zemp, Daniel Gregorowius and Nikola Biller-Andorno analyse and discuss different understandings of life and how they can enrich the debate about synthetic biology. They suggest that a diversity of views on life should be incorporated into public education, public engagement activities and ethical and technology assessment research on synthetic biology. Based on a thorough analysis of different notions of life, Deplazes-Zemp and her colleagues argue that all participants in the debate on synthetic biology may gain from this diversity in various ways. Moreover, in their opinion, this debate provides an opportunity to practise moral attitudes, such as respect and tolerance, which are central to a democratic society. An exchange and comparison of different views on life could thus give the debate about synthetic biology a special meaning and importance that transcends preventing conflict or fostering acceptance. We may add that it is still a major challenge for synthetic biologists and other practitioners of technoscience to fully grasp that the messy ‘real world’ of modern democracies is not one in which decisions are taken purely on the basis of scientific evidence. As long as they do not violate human rights or other tenets of modern democracy, citizens’ value-based preferences can be deemed legitimate factors in political decision-making, even if many scientists (correctly or erroneously) judge some of them to be irrational. Given the growing irrationalism at the heart of science itself (cf., again, [9]), we should not flirt with technocratic solutions, but embrace the diversity of views on the future of science, technology and society.

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