Recent developments in nanotoxicology

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Published online: 17 April 2012
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Nanotoxicology addresses the adverse effects of manufactured nanomaterials in biological systems (Weiss and Diabaté 2011). A particularly attractive feature of this discipline is that it brings together scientists from various disciplines, including toxicology, physics, chemistry, biology, medicine and engineering. Although a lot of progress has been made in recent years, some key questions are still not yet sufficiently answered:

- To which degree are the ions released from the nanoparticles responsible for toxic effects?
- To which degree do the physical properties (size, shape, agglomeration) of the nanoparticles contribute to its toxicity?
- Can nanoparticles accumulate in the body? If yes, in which cell types and subcellular structures?
- How can in vitro tests contribute to risk assessment?
- To which degree does oxidative stress explain toxicity of nanoparticles?

The editors are pleased that Carsten Weiss and Silvia Diabaté from the Karlsruhe Institute of Technology organized a special issue addressing these key questions. The articles are highly recommended to all who are interested in nanotoxicology (Table 1).

Table 1 Key messages from the recently published special issue on nanotoxicology (Weiss and Diabaté 2011)

Key messages	References
Quantum dots are frequently used to label cells. This article reviews the toxicity and biological behaviour of quantum dots and reports that the capping material, rather than the core complex, is relevant for toxic effects	Hoshino et al. (2011)
This article reviews possibilities and limitations of in vitro testing in nanotoxicology	Clift et al. (2011) (review)
Nanoparticles can activate various signalling pathways including ERK, p38, JNK as well as NFκB and Nrf-2. Interestingly, when these pathways are activated, oxidative stress is observed. This article demonstrates that not all toxic effects of nanoparticles can be explained by oxidative stress	Marano et al. (2011)
Silver nanoparticles cause oxidative stress and induce bulky DNA adducts in a human lung cancer cell line	Foldbjerg et al. (2011)
Industrially manufactured nanoparticles can be radiolabelled by a cyclotron-based irradiation technique and are suitable for in vitro and in vivo tracing studies	Gibson et al. (2011)
High-aspect carbon nanotubes (diameter, 10–15 nm; length, 10 μm) are more cytotoxic than low-aspect nanotubes (diameter, 10–15 nm; length, 150 nm). However, both high- and low-aspect nanotubes were negative in the Ames test, in vitro chromosome aberration test and in vivo micronuclei test	Kim et al. (2011)

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Table 1 continued

Key messages	References
Depending on the type of functionalization, lead sulphide nanoparticles show different degrees of toxicity to embryonic zebrafish. This may be explained by the different extent of released soluble lead ions	Truong et al. (2011)
DNA strand breaks observed after incubation of colon carcinoma cells with platinum nanoparticles are caused by released platinum ions	Gehrke et al. (2011)
Silica nanoparticles accumulate in endosomes of HeLa cells. In contrast, they do not accumulate in nuclei or mitochondria	Al-Rawi et al. (2011)
The capacity of titanium dioxide nanoparticles to induce pulmonary irritation and inflammation in mice is low	Leppänen et al. (2011)

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