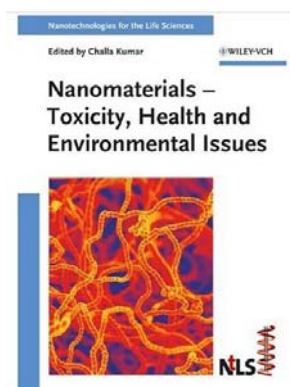




## Book Review: Nanomaterials - Toxicity, Health and Environmental Issues

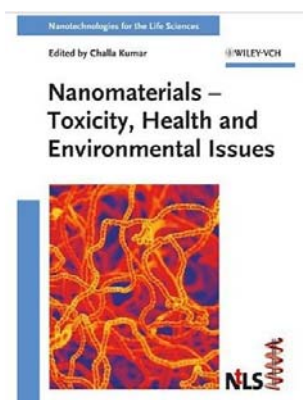
Edited by Chalia Kumar. Wiley-VCH. ISBN: 3-527- 31385-0, 333 pp; 2100 (hardback)



This Book review was authored by JD Kilgour of Syngenta, and was sourced from the [British Toxicology Society](#) Newsletter, Summer 2007.

"Constituting Volume 5 of the Nanotechnologies for the Life Sciences (NtLS) series, this book surveys 3 major issues related to nanomaterials - toxicology, health and the environment. The book is divided into 3 sections, each focussing on one of these major issues, whilst it is recognised that there is considerable overlap between these areas..."

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**Section I** entitled "**Toxicity**" contains chapters on **biotoxicity of metal oxide nanoparticles** and the **ecotoxicity of engineered nanomaterials**. The first considers potential routes of exposure and concentrates on the toxicity of metal oxide-containing particles, as demonstrated exclusively by in vitro evidence. The second considers the existing widespread incidence of nanoparticles in the environment, their fate and the many unknowns remaining in this area. These two chapters act as an introduction to more detailed and extensive coverage of these subjects in subsequent sections.

**Section II** on "**Health**" explores some of the concepts introduced in Section I in more depth. The first chapter on the impact on health of nanoparticles chapter on the **impact on health of nanoparticles** covers potential sources of nanomaterials, epidemiological evidence for health effects, routes of exposure (including inhalation, dermal and gastrointestinal routes), dosimetry, epidemiology and toxicology of nanomaterials. The question "Why are nanoparticles so dangerous?" is posed, followed by discussions on the properties of

nanoparticles that give them this potential, including biopersistence and size. Potential interactions with the blood brain barrier and the prothrombotic potential of nanomaterials are discussed.

The next chapter on **dosimetry, epidemiology and toxicity** looks at translocation of nanomaterials within the body, links between cardio-vascular disease and PM (particulate matter) exposure. The important subject of relevant parameters to use when dealing with nanoscale materials is discussed, emphasising the importance of relating dose and health effects to surface area of particles. The next chapter on the **impact of ceramic and metallic nano-scaled particles on endothelial cell functions in vitro** covers the pro-inflammatory properties of nano-particles, again using in vitro evidence. The chapter on **carbon nano-tubes** covers the different forms of these (including C60 "Buckminsterfullerene" and others) and their properties, such as their tendency to form aggregate particles and the presence of metals as impurities implications of these for toxicity. Applications for these materials (such as in the electronics, computer and aerospace industries), aspects of occupational exposure in manufacturing and occurrence in the environment are also discussed. Epidemiological and animal study-based evidence is presented for the known pathological effects of these materials

following inhalation exposure (granuloma). A further chapter on **new carbon conformations and metal oxides** covers similar ground, but goes on to consider risk characterisation and risk assessment.).

**Section III on "Environment"** begins with a chapter the use of **nanomaterials for environmental remediation**. Here, the very properties of nanomaterials which are problematic toxicologically are shown to be advantageous in terms of their utility for cleaning and decontamination of the environment. For example, the high surface area/mass ratio and adsorptive properties are useful in removal of some chemicals for water/air, and their reactivity in terms of acid-base and redox reactions, chelating properties etc are useful for other applications. The next chapter focuses specifically on **water treatment** in general and the next on the **removal of endocrine-disrupting chemicals in water**. A chapter on **nanosensors for environmental applications** covers the development and use of piezoelectric micro-cantilever sensors capable of detecting water-born pathogens such as Salmonella typhimurium and Bacillus anthracis, and airborne chemical agents such as nerve gases. This method provides rapid in situ and sensitive measurements, in contrast to existing technologies based on colony growth or fluorescence techniques. The final chapter looks at the **toxicology of nanoparticles in environmental air pollution**. Initially this

chapter briefly reviews the history of studies on the adverse health effects of air pollution, from the London smogs of centuries ago, through the peak of activity on the 'ultrafine hypothesis' in the mid 1990s to the state of knowledge today. For the latter, a more detailed account of our current understanding of the mechanisms by which nanoparticles play a role in the adverse health effects associated with air pollution is given.

As with many books of this type (comprising chapters written by a number of different authors) the book suffers from a certain degree of repetition. In addition, because there is so much overlap between the main 3 topics, the way the book is organised is only partially successful in that information may not be where you would expect it to be, and doesn't always sit logically where you find it. However, a reasonable index goes some way to compensating for this.

There are some notable names amongst the contributors to this book, and each chapter is individually referenced. Overall, this book is a good starting point for anyone wishing to acquaint themselves with the key issues relating to nanomaterials and their toxicology, health and environmental effects. It presents an accurate picture of the state of knowledge in this field to date.

JD Kilgour Syngenta, UK

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