

**Nanotoxicity: Experimental Toxicology
of Nanoparticles and Their Impact on Humans**

The fast developing nanotechnology markets have led to an increasing risk of human exposure to nanoparticles, through the lungs or the skin, but also by ingestion, or by injection in the form of medicines.² Indeed the applications of nanotechnology are many and varied. They are already present in our day-to-day lives in such everyday products as cosmetics and body lotions, electronic and household goods, food packaging, and clothes, and the list gets longer all the time. There are particularly interesting medical applications. Many of these products provide no clear indications of such contents and an assessment of the risks for humans and the environment is only required for certain nanoparticles, depending on the level of production and their usage, in particular in the medical area. Discussions are currently under way to define a regulatory framework that would allow us to control the risks of disseminating these products, both for the consumer and for the environment.

Exposure to nanoparticles may be professional, environmental, or medical, and it concerns a variety of nanoparticles used in a broad range of different forms. However, the rapid evolution of this technology, expected to constitute the industrial revolution of the twenty-first century, makes it essential to evaluate the risks and hazards as early on as possible, on the basis of a better understanding of their biological effects.

The following chapters, written by recognised specialists in the field of nanotoxicology, the toxicology and metrology of atmospheric particles and fibres, and the assessment of environmental risks for humans, relate the current state of understanding in this area. They describe the results of experimental work in toxicology. Indeed, toxicologists were the first to warn public health authorities of the increased risk due to particles with a given chemical composition when they come into contact with living systems in a nanometric form. While our understanding regarding human exposure and its consequences remains highly uncertain, experimental results on other animals or in vitro on cell cultures are sufficiently clear in some cases to allow an evaluation of the risks, even in a situation of uncertainty. From the beginning, nanotoxicology has followed a different approach to the one traditionally used in regulatory toxicology. In particular, it incorporates the latest models and techniques of modern molecular and cellular biology, allowing a systemic approach. This evolution, one might even say revolution, in toxicology is especially relevant when the type of exposure is difficult to characterise, doses are very low, and effects are varied. The data presented in the next eleven chapters provide a snapshot of a particularly fast evolving field of research, but they will nevertheless serve as a solid foundation for the reader who wishes to familiarise herself or himself with this complex area, an area where society as a whole is especially interested in a proper evaluation of the risks and hazards.

² Introduction by Francelyne Marano, President of the *Groupe de veille sur les impacts sanitaires des nanotechnologies* and member of the *Haut Conseil de Santé publique*.