Oral

Toxicological and Environmental Issues of Inorganic Nanomaterials

Isaac Ojea-Jiménez, *Victor Puntes*
Institut Català de Nanotecnologia, Campus UAB, Building Q (ETSE), 3rd floor, Cerdanyola del Vallés, 08193, Spain
Isaac.Ojea.icn@uab.es

Nanoscience envisages a new scientific frontier, in which materials on the length scale of some millions of a millimetre can be engineered. There are significant potential applications of nanotechnology for the benefit of mankind, these ranging from information technology, energy storage and harvesting, and radically new medical technologies: objects in the nanoscale interact with organisms in a fundamentally new way, thus creating common links between nanotechnology and biology. The development of durable, secure and reliable knowledge in this field will be an investment with lasting positive impact. Despite significant R&D investment over the last 10 years, several critical limitations to rapid implementation and commercialisation in a safe and responsible manner were not fully foreseen. The real unknown hazards and risks of nanomaterials, together with concerns about the reliability of current testing approaches have considerably been highlighted from science, media and even to the highest levels of government. In addition, manufacturing of standards and workplace practices of materials are not uniform across market sectors and in different parts of the world. In the absence of an understanding of what constitutes useful standards, the reputation of nanotechnology could be affected by the weakest players. For example, from conventional issues of impurities, wich are unconventionally present in nanomaterials, serious issues involving biocompatibility, stability and others have arisen.
Significant variability of reported biological and toxicity outcomes on nominally identical materials has caused controversy in science and media. Therefore it is crucial the need for standardization in nanotechnology, whether in academic research, regulatory or industrial areas, in order to converge on basic results from identical experiments. At this stage even simple issues must be resolved, such as the presentation of nanoparticulate positive controls, which have profound effect in the way that the community performs its work. Physicochemical and other analytical characterization in the biological and safety contexts are quite different from analysis of nanomaterials for other applications. However, some relevant physicochemical properties of nanomaterials are yet not fully understood. The fact that engineered structures have access to biological environments, combined with their unique (high surface-area) properties, implies that materials quality and reproducibility are important for long term in industry. There is a critical need to separate issues of quality from the tough questions of intrinsic nanoparticle safety.
The underlying theme should be a new quality-based research and application consensus where the emphasis is not just on the novelty of a given experiment, but also its reliability and robustness. And this should affect to all aspects of nanomaterials production, processing, characterization and analysis in a biological and environmental context.

References:

[1] http://www.nanowiki.info/#nanotoxicology and references there in.

Figures:

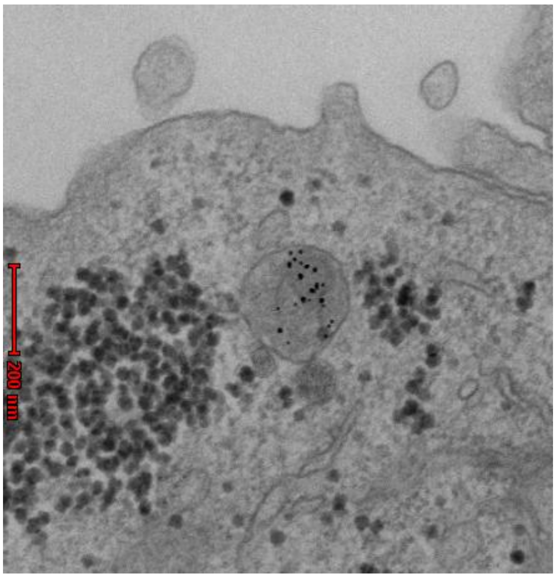

Figure 1. Nanoparticle internalization in HeLa cells

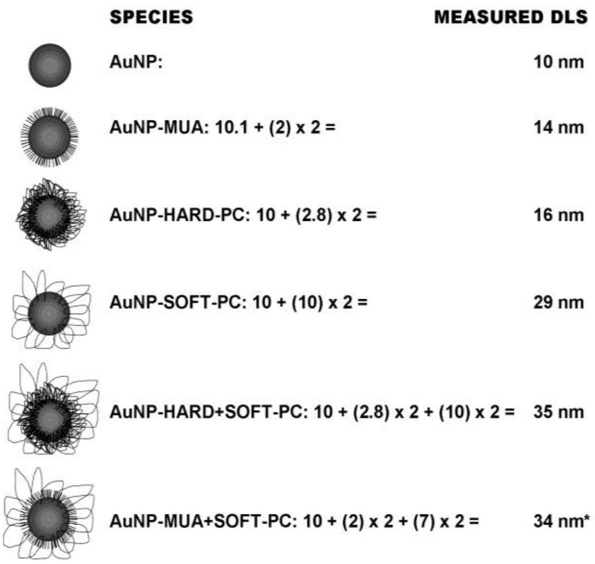

Figure 2. Different species of Protein Corona (PC) depending on size of the nanoparticle, after mixing with a biological media