

Cellular Interaction and Toxicology with Engineered Nanoparticles

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Background

The estimated global production rates for various nanomaterials for the period 2005-2010 are 103 (tones/annum) for structural applications (ceramics, catalysts, coating, powders) as well as for skincare products (metal oxides such as titanium dioxide, iron oxide or zinc oxide). The worldwide market for nanoparticles (NPs) alone is estimated as having a turnover of about 900 Millions \$ in 2005 (annual increase of 13 %). Sales of products incorporating emerging nanotechnology will increase from less than 0,1% of global manufacturing output today to 15% in 2014 (LuxResearch).

The lack of toxicology data on engineered NPs has so far not allowed for adequate risk assessment. In order to reduce the level of possible opposition towards the nanotechnology industry as well as towards research in this area it is necessary to identify potential hazards from exposure to NPs, and to develop a scientifically defensible database for the purpose of risk assessment.

CellNanoTox project

CellNanoTox addresses the needs of the European society for assessing the risk of occupational and general population exposure to industrially manufactured nanoparticles (NPs). It is expected to generate new knowledge on potential health risk or the absence of it, providing objective arguments for recommendations and regulations. Currently there is a lack of sufficient toxicology data on engineered NPs which has so far not allowed for adequate risk assessment. NP toxicity measurement is highly complex and requires various cutting edge technologies, validation expertise, and industrial know-how for combining basic research knowledge and application as well as for advancing in the testing field. Therefore, the CellNanoTox consortium is made up of experts of several scientific fields, coming from well known European research centres, universities and major industries.

The research project CellNanoTox aims at the development of innovative multidisciplinary sets of tests and indicators for toxicological profiling of nanoparticles (NPs) as well as at unravelling the correlation between the physicochemical characteristics of NPs and their toxic potential on various organs of the human body. It was shown that the penetration of NPs into the human body proceeds principally through inhalation or orally, whereas penetration through healthy skin is restricted. We have, therefore, chosen to study lung and intestine as the primary

interacting tissues/organs with NPs, while liver, kidney and the immunological system have been selected to be the secondary major sites of interaction, following the penetration of NPs into the blood circulation. The interaction of the NPs with these different target organs will be studied by employing in-vitro cell systems as well as ex-vivo studies based on precision-cut slices of lung, liver and kidney as alternatives to animal experimentation.

This research program focuses on understanding the relationship between size and surface chemistry on the deposition, uptake, translocation, and toxicity of a few selected industrially important NPs as well as novel synthesized NPs, whose size and surface chemistry will be methodically modified. It is intended to identify potential hazards from exposure to NPs, and to develop a scientifically defensible database for the purpose of risk assessment.