Editorial

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With the advent of nanotechnology, the prospective use of engineered nanomaterials, defined as materials with a diameter below 100 nm, in many applications, due to their advantageous properties, has progressed rapidly. Over the last decade however, there has been increased debate regarding the potential harmful effects of nanomaterials. Predominantly, heightened concern has been expressed regarding the (potential) adverse health effects of nanoparticles (NPs). A plethora of both lab-based and epidemiological studies have previously indicated that inhalation of combustion derived NPs can cause adverse health effects, as well as augment pre-existing diseases, such as chronic obstructive pulmonary disease. Although there are obvious differences between combustion-derived NPs; which are polydispersed and have a chemically complex nature; and engineered NPs; which are in contrast monodispersed with precise chemically engineered characteristics; the same toxicological principles are assumed.

Although the risk posed by exposure to accidentally produced NPs is still pertinent, it is not however, simply exposure to these NPs (predominantly occurring via combustion processes or in an occupational setting) which should be approached with caution. Engineered NPs are specifically manufactured for a diverse range of consumer, industrial and technological applications, such as medicine, cosmetics, environmental remediation and information technology. Due to the inevitable exposure of NPs to humans, owing to their use in such applications, it is thus imperative that an understanding as how NPs interact with the human body is gained. In addition, since NPs are released into the environment, it is important to obtain information pertaining to the consequences for which this exposure resembles.

Research charged with understanding these effects, aptly termed ‘nanotoxicology’, is a multi inter-disciplinary field of sciences, and the main purpose of this special issue was to assemble information specific to nanomaterials and their possible toxicity relative to a variety of different experimental systems, covering the many different scientific backgrounds within the field of nanotoxicology. For example, it is indispensable to develop techniques for a safe and reproducible generation of particular NPs as described by ‘Shah’ for metal (lead) oxide NPs and ‘Shah and Al-Marzouki’ for magnesium oxide nanoflowers. In addition to this, the characterisation of NPs is essential, as addressed by ‘Perrenoud et al.’, who present a new exposure system for brake wear particles and the description of the exhaust emission composition. In order to fully understand the effects of NPs, cell free systems are also a valid addition to any toxicological analysis. In the study by ‘Zupanc et al.’, a new approach to how to study lipid-NP interactions is presented. Understanding the effects of NPs on the environment, the release into the environment and effects of CdS/CdTe quantum dots to rainbow trout gills was investigated by 'Louis et al.', whilst the genotoxicity and teratogenicity of silica nanocrystals during the embryonal and postnatal development of rats was evaluated by 'Durnev et al.', highlighting the potential for NPs to translocate from the lungs, as well as the various different exposure routes for which NPs can gain access to biological systems and if NPs can still induce negative effects to normal cellular homeostasis. Finally, ethical issues should also be considered. This was addressed in the study by 'Faunce' who explored the safety of NPs in Australian sunscreen.

To approach all of these open questions regarding nanotoxicology, it is important that scientists from various fields, such as chemists, physicists, biologists and clinicians, work together. In this special issue Nanotoxicology, multidisciplinary challenge was addressed. Therefore, not only the toxic potential of engineered and combustion-derived NPs on living systems was considered but also the generation and characterisation of the material as well as ethical issues.