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**Extrapulmonary Effects of Inhaled Nano-sized Particles**

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Airborne ambient ultrafine particles (<100 nm) generated by combustion processes and airborne engineered nanoparticles (1-100 nm) comprise a category of nano-sized particles that have very specific properties with respect to their deposition in the respiratory tract (governed by diffusional processes) and with respect to their retention kinetics and clearance pathways (translocation across alveolar-capillary barrier into blood circulation and uptake and translocation by sensory nerve endings in the respiratory tract). Some epidemiological studies have found an association between ambient ultrafine particles and respiratory and cardiovascular effects in susceptible parts of the population. Controlled clinical studies and animal studies have observed cardiovascular effects following inhalation exposure to ultrafine carbon particles. Collectively, these studies raise questions about potential harmful effects of ambient ultrafine particles and also about nanotechnology when humans will be exposed to engineered nanoparticles. Nanotechnology is defined as research and technology development at the atomic, molecular or macromolecular levels, in the length scale of ~1-100 nm range. One of the many promising applications of engineered nanoparticles is in the area of medicine, for example, targeted drug delivery as aerosols and to tissues which are difficult to reach. The discipline of nanomedicine has arisen to develop, test, and optimize these applications. However, the same properties that make nanoparticles attractive for development in nanomedicine and for specific industrial processes could also prove deleterious when nano-sized particles reach extrapulmonary target organs. An emerging discipline – nanotoxicology, which can be defined as safety evaluation of engineered nanostructures and nanodevices – is gaining increased attention. This presentation summarizes results of studies with nano-sized particles (ultrafine particles and engineered nanoparticles) with a focus on the respiratory tract. Examples of translocation and effects of nano-sized particles into the vascular system and central nervous system and presumed mechanisms will be highlighted. They illustrate, on the one hand, that we need to be aware of possible acute adverse effects and potential long-term consequences of exposures to both ultrafine particles and engineered nanoparticles; on the other hand, the findings also give us ideas about the intriguing possibilities that engineered nanoparticles offer for potential use as diagnostic tools or as therapeutic delivery systems. Importantly, in order to eliminate or reduce unintentional ultrafine particle exposures from anthropogenic emission sources regulatory measures need to be established.

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