Poster: nanotoxicology / nanobiotechnology

An epithelial airway model to study the effects of gold nanoparticles deposited at the air-liquid interface

Christina Brandenberger[0], Anke-Gabriele Lenz[1], Christian Mühlfeld[0], Otmar Schmid[1], Konrad Ludwig Maier[1], Peter Gehr[0], Barbara Rothen-Rutishauser[0]
[0] Institute of Anatomy (Bern) (CH); [1] Helmholtz Zentrum Munich (Munich) (DE)
e-mail: brandenberger@ana.unibe.ch

Potential health effects of nanoparticles (≤ 100nm) associated with human exposure are poorly investigated. In order to avoid and to replace toxicity studies with animals, we have established and evaluated a triple cell co-culture system composed of epithelial cells, macrophages and dendritic cells which simulates the most important barrier functions of the lung epithelial airway. With this model we investigated the potential immune response after exposure to gold nanoparticles (diameter of 15nm). Gold nanoparticles are already used in different biological applications *in vitro*.

Cells, cultured at the air-liquid interface, were exposed to two different particle concentrations ($2.5x10^9$particles/cm^2, $2.5x10^{10}$ particles/cm^2) and then further incubated for 4h and 24h. We measured the inflammatory mediators IL-8 and TNF-alpha by qRT-PCR (mRNA) and ELISA (protein). The intracellular particle localization was investigated by transmission electron microscopy (TEM). Additionally we pre-stimulated the cells with lipopolysacharids (LPS) to simulate a chronic inflammation at the time point of particle exposure.

By TEM we could show that the particles enter the cells as single particles or as smaller agglomerates. Particles were mainly localized in intracellular vesicles. In terms of inflammatory effects, gold nanoparticles did not cause a significant reaction at both time points and exposure concentrations. When priming the cells with LPS, a clear immune reaction due to LPS was observed by elevated IL-8 and TNF-alpha mRNA and protein levels. However, a combination of LPS with gold nanoparticles did not cause any difference in mRNA or protein release compared to the LPS reaction itself.

Using an advanced cell culture model of the human epithelial airway barrier at the air-liquid interface, we have shown that 15nm gold nanoparticles did not induce an immune reaction or to burst a reaction in a pre-stimulated system, although particles clearly enter the cells. Further studies on translocation and retention of particles are still needed to conclude on their safety.

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Keywords: cell culture model, airway epithelium, nanoparticles, inflamatory response