

Some characteristics of the pulmonary phagocytosis response to deposition of different metal nanoparticles

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Suspensions of gold (50 nm), silver (49 nm) or copper (40 and 50 nm) nanoparticles and silver or copper microparticles (1 μm) were instilled intra-tracheally to rats. Cell population of broncho-alveolar lavage fluid (BALF) obtained 24 hrs later was studied with optical, transmission electron (TEM) and semi-contact atomic force microscopy (sc-AFM).

All nanometals evoked much more significant recruitment of phagocytic cells to the free surface of lower airways as compared with their micrometric counterparts. A marked increase in the count ratio of NLs to alveolar macrophages (AMs) testified for high cytotoxicity of all nanometals but for nanoparticles of similar diameters this response depended on their chemical nature, that to nanogold being the least while that to nanocopper - the most pronounced. Within both AMs and NLs we saw a lot of nanoparticles and obtained TEM and sc-AFM images proving the important part played by active endocytosis, rather than by diffusion only, in nanoparticles' internalization. This inference is in agreement with that earlier made by us from a similar experiment with Fe₃O₄ nanoparticles which demonstrated also that the NL/AM index and avidity of phagocytosis increased with decrease in particle diameter. We found marked differences between different nanoparticles as concerns the intracellular distribution, the most important being the ability of gold and copper, but not of silver and iron oxide to penetrate into nuclei and more marked affinity of the latter two to mitochondria with expressed damage to these organelles.

Biography

Larisa I. Privalova, M.D., D.Sc., graduated from Sverdlovsk State Medical Institute (Russia) as a Doctor of Medicine in 1972, and since then is working in the Ekaterinburg Medical Research Center for Prophylaxis and Health Protection in Industrial Workers where she is now the Head of the Laboratory of Scientific Principles of the Biological Prophylaxis. She has got experience in studying: Toxicology of low-soluble industrial dusts and of metallic nanoparticles; mechanisms controlling pulmonary dust kinetics; establishing occupational exposure limits; environmental epidemiology and risk-assessment. In these fields, she co-authored several monographs and many scientific papers in peer-reviewed Russian and international journals.

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