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TOXICOLOGY OF NANOPARTICLES: ROS PRODUCTION, GENOTOXICITY AND MUTAGENICITY CAUSED BY CARBON BLACK

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Nanoparticles have shown many promising applications in medicine, science and technology due to size and behavior. Anything from drug delivery to strong lightweight materials are in the pipeline. However, smaller is not always better. Nanoparticles are often more reactive than large particles due to the higher surface area. Additionally they are more likely to translocate from the site of deposition, and thereby able to cause effects in multiple distant parts of the body.

The National Research Centre for the Working Environment conducts research on the effects of inhalation of Nano sized particles. One of the tested particles is a 99% pure Nano sized carbon black (CB; Printex 90, Evonik). Carbon black is used in major scale (>10 million metric tons/year) as a solid component in rubber, plastic, ink and paint industries (including black tattoo inks).

In an attempt to describe pulmonary toxicity and identify a possible mechanism of action for CB, we have performed a range of in vitro and in vivo experiments. I will show that CB, Printex 90 cause in vitro genotoxicity and mutations. And that detailed characterization lead to identify reactive oxygen species (ROS) as a likely mode of action. This hypothesis was supported by a mutation spectrum analysis showing increased G:C to T:A, G:C to C:G, and A:T to T:A mutations, in keeping with a genetic finger print of ROS production. This result substantiates the hypothesis of the mechanism of action. Also it underlines the importance of previous and new data showing that CB also induces strand breaks in BAL cells, lung parenchyma and liver tissue following pulmonary exposure in mice animals.

I will try to relate these results to possible effects in dermis/proximal lymph nodes following tattoos, and include possible outcomes if PAH rich CB is used, as well as give suggestions on possible future research in the area.