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Advances in Nano-technology and Their Applications

Kimmo Arana*

Department of Pharmacy, University of Eastern Finland, Joensuu, Finland

***Corresponding author email:** arana.kimmo57@yahoo.com

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DESCRIPTION

Rapid advances in nanotechnology are likely to provide significant advantages to humanity. However, as with any new technology, these advantages are likely to be followed by risks, possibly new risks. Nano-toxicology is evolving in tandem with nano-technology, with the goal of defining the hazards associated with nano-materials: Risks can only be controlled once they have been identified. This article provides an explanation for concern about the possible health effects of nanomaterial exposure and compares them to evidence of the health effects of ambient aerosol. A number of hypotheses are proposed, and the risks of accepting unsubstantiated hypotheses are emphasised.

Nanotechnology has a strong claim to be considered as the first significant technological advance of the third millennium. This is an amazing thought: who wants to guess what other advances will occur in the next thousand years? Science fiction may be as good as a predictor of such developments as science itself, for those who fantasise about space elevators made of woven nano materials generated on asteroids by self-replicating machineries, Kim Stanley Robinson's trilogy Red Mars, Green Mars, and Blue Mars is highly recommended. Some of the applications involved in nano-technology are listed below.

MRI labelling

Iron Oxide Nanoparticles (IONPs) of various sizes are used to classify stem cells, which include Super Paramagnetic Iron Oxide Nanoparticles (SPIONs) with diameters ranging from 50 nm to 200 nm and Ultra-Small Super Paramagnetic Iron Oxide (USPIO) nanoparticles with diameters of approximately 35 nm. The low intracellular labelling efficiency of SPIONs for labelling Mesenchymal Stem Cells (MSCs) is their main limitation. Due to particle dilution, the MRI signal hypo intensity induced by those nano-particles doesn't really represent the actual live cell types after many rounds of cell division.

Optical Labeling

OL (Optical Labelling) is the process of introducing a fluorescent signal into cells, primarily in the near-infrared region. The method involves labelling cells with a fluorescent tag *ex vivo*, engrafting the labelled cells, and visualising their concentration in particular target cellular components of interest. OL is as susceptible as radiolabel-based imaging technology but does not require any irradiation. OL allows for the non-invasive tracking of cells on a regular basis, providing new insights into tissue regeneration to the target location.

Multimodality imaging

Combining numerous small molecules imaging modalities can provide synergistic benefits over every one modality alone. Trying to combine an advanced optical particular form with 3D tomographic methodologies such as positron emission tomography, single-photon emissions computed tomography, or MRI can enable non-invasive imagery in human patients with higher sensitivity and/or accuracy while maintaining the required resolution.

Nanotechnology is relatively new and rapidly expanding. As with any new technology, advantages and disadvantages will be encountered. The assignment of the nano-toxicologist is to identify health risks before they cause harm. This is not an easy task to know about all of the risks that should be investigated, hence more research is required. Industry may reasonably be expected to investigate the safety (or danger) of their products, but a comprehensive programme of basic research is required to identify potential risks and to determine the mechanisms by which nano materials may affect the body.