Research on Nanotechnology and Human Health at Lund University, Sweden

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Methodologies are developed and exploited on various biological, ecological and societal levels in order to get information on effects of nanoparticles. The work is conducted in a number of departments and two national Centers of Excellence: The Nanosafety programme (coordinator Prof. Sara Linse) within the Lund Nanometer Consortium (www.nano.lth.se) and METALUND (Medicine and Technology for Society and Working Life) (www.metalund.lu.se) (coordinator Assoc. Prof. Maria Albin). Studies have been/are/will be conducted on the effects on different levels: on a) biomolecules, b) on cell cultures, c) on humans and d) on ecosystems and society.

a) When entering a biological fluid, nanoparticles become covered by biomolecules that create a complex corona around each particle. The composition and characteristics of the corona is determined by the particle size, shape and surface characteristics and the chemical nature of the surroundings. The understanding of these effects can constitute the basis for nanotoxicology. (Sara Linse, Tommy Cedervall, Knut Deppert et al.)
b) Methodology is being developed where cell cultures can be exposed with particles from airborne phase directly to the cells (Jenny Rissler, Knut Deppert et al. together with Steffen Loft at the University of Copenhagen). There are also studies on survival, cell death and cell membrane integrity by respiratory assays, immunocyto/histo chemistry and dye exclusion. Fast confocal, holographic, scanning/transmission electron microscopy is used to image nanostructures, cells and tissues (Martin Kanje et al.)
c) Studies of humans exposed to nanoparticles are performed in well controlled laboratory settings. A number of biomarkers (e.g. inflammatory markers, physiological response of the respiratory system and heart rate variability has been studied (Mats Bohgard, Jörn Nielsen Joakim Pagels, Maria Albin, Inger Hagerman (Karolinska Institutet) et al.). Epidemiological methods are used for particles in ambient air (Kristina Jakobsson et al.). Devices are developed for assessing exposures to nanoparticles in work environments (Anders Gudmundsson et al.). A method RESPI has been developed for experimental determination of deposition rate of nanoparticles in the human respiratory tract (Jakob Löndahl, Erik Swietlicki et al.).
d) There are also plans to study the fate, uptake and effects of nanoparticles in different environments, aquatic and terrestrial, at different scales (Olof Berglund et al.). A proactive plan focuses on the safety and risk management during the life-cycle of nanomaterials, including all steps from design, manufacture, use, waste, uptake, release, persistence, etc. to enable work towards a sustainable society (Roland Akselsson, Åsa Ek et al.).