Airborne nanoparticles and their potential health effects

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Nanoparticles in biological environments

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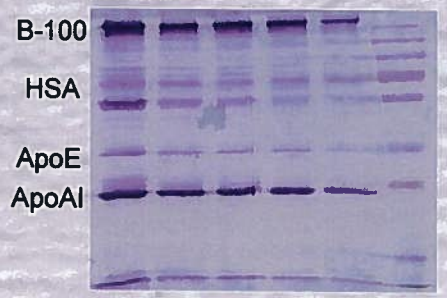
Manufactured nanoparticles are increasingly used in a number of applications leading to increased exposure of nanoparticles to humans and the environment. Concerns have been raised about how manufactured nanoparticles will affect the human body and the environment. We have studied how nanoparticles interact with biomolecules in biological fluids and how these interactions can affect the structure and function of proteins. In biological fluids nanoparticles will be covered by a defined set of proteins, a protein corona. This new surface is important for the biological fate of the nanoparticles in the body. The identity of the proteins in the corona is determined by the material and the size of the nanoparticles. Proteins in fat metabolism, blood coagulation, and complement system are often part of the protein corona and different nanoparticles influence these systems in different ways.



Blood proteins bound to mannan nanogels

The organisers thank you for your participation!

Anna Assarsson

Karin Mattsson

Irem Nasir

MINISYMPOSIUM

3 FEBRUARY 2012

13:15 KC:A

AGENDA

13:15

Airborne nanoparticles and their potential health effects

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COFFEE BREAK

14:45

Towards understanding the importance of the interactions between nanoparticles and cell membrane bound receptors

Sourav Bhattacharjee

Laboratory of Organic Chemistry, Wageningen University
The Netherlands

15:30

Nanoparticles in biological environments

Tommy Cedervall

Center for Molecular Protein Science
Lund University

after the talks

pub in CMPS coffee room

Airborne nanoparticles and their potential health effects

Mats Bohgard

Division of Ergonomics and Aerosol Technology
Lund University

Airborne particles have been a threat to health for several hundred years. In 1713 the Italian physician Bernadini Ramazzini published *De Morbis Artificum*. This was probably the first report about the disease we today call "silicosis". Many destroyed lungs and early deaths can be attributed to silicosis throughout the centuries. Airborne particles can be generated by: *disintegration* of materials, *nucleation-condensation processes* where gases/vapours nucleate/condense to small particles and *chemical reactions*. Exploitation of nanotechnology can drastically increase emissions of nano-sized particles into the air during the life cycle of the materials. Many studies have shown that exposures to airborne particles are associated with respiratory and cardiovascular mortality and morbidity. There is a need for toxicological methods to assess risk in the early stages of technical development. The knowledge of fundamental mechanisms of biological effects should be incorporated into the development process. Otherwise, we may have to wait centuries as we did from Ramazzini's report on illness. Pro-active measures will save lives and health.

Towards understanding the importance of the interactions between nanoparticles and cell membrane bound receptors

Sourav Bhattacharjee

Laboratory of Organic Chemistry, Wageningen University
The Netherlands

Although physical characteristics (like surface charge, size, crystallinity, porosity etc) of nanoparticles (NPs) had been claimed to be important factors for the cytotoxicity and cellular uptake of NPs, it is rather a recent development that cell membrane bound receptors (like clathrin, caveolin, mannose etc) were found to impart considerable effects on the cellular interactions of NPs. To investigate monodisperse, fluorescent polymeric nanoparticles (PNPs) of different sizes and surface charges were tested in rat macrophage NR8383 cells. A surface charge (clathrin and caveolin receptors interacted more with cationic and anionic PNPs, respectively) and size dependent (clathrin and caveolin receptors interacted more with smaller and bigger PNPs, respectively) interaction of PNPs with the clathrin and caveolin receptors were observed. Similarly, hydroxyl terminated PNPs interacted more with mannose receptors. By selective blocking of the clathrin and caveolin receptors, the cellular uptake of the different PNPs could be influenced. Taken together, this knowledge of specific interactions between the PNPs with cell membrane bound receptors can help in the development of more biocompatible and medically applicable PNPs of future.

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