Uptake, biological fate, biodistribution and toxicological studies of engineered nanomaterials

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There is an urgent need for a deeper understanding of the impact of engineered nanomaterials (ENMs) on human health resulting from deliberate exposure to ENMs, such as in nanomedicine, or from accidental exposure due to handling or using devices or products containing ENMs.

The `physico chemical characteristics of ENMs, such as shape, size, degradability, aggregation, surface and core chemistry of ENMs determine their interaction with biomolecules and the ENMs fate both intracellularly and at body level. Therefore, for the assessment of ENMs toxicity is necessary to correlate ENMs characteristics with the fate and biological interactions.

Studying the fate of nanomaterials at the cellular and body level is indeed a requisite for the assessment of their toxicity, and impact on cellular functions. ENMs fate *in vivo*, distribution per organ, accumulation and biodurability are fundamental in order to assess how the nanomaterial affect biological functions. ENMs translocate and may finally reach the cell interior. Several issues related to the physical state of the nanomaterial, including aggregation, the interaction with biomolecules in different cellular environments, the formation of protein corona and the dynamics of ENMs will guide the intracellular action of nanomaterials.

In this presentation different aspects of nanomaterials fate *in vitro* and *in vivo* will be presented. Uptake and intracellular fate of metal oxides nannoparticles (NPs) ,surface modified carbon nanotubes, and engineered poly(lactide co glycolic) nanoparticles (PLGA NPs) will be studied by a Raman Confocal Microscopy, Confocal Laser Scanning Microscopy, Flowcytometry and when relevant by means of TEM We will show the application of Flowcytometry and Raman Microscopy. To study the intracellular degradation of PLGA NPs.The intracellular dynamics of gold NPs and metal oxides, state of aggregation and intracellular size will be studied by means of Fluorescence Correlation Spectroscopy. The intracellular dose for metal oxides NPs will be obtained from Ion Beam Microscopy measurements.

The bio distribution, organ accumulation and fate of radiolabelled metal oxide NPs will be studied in animal models by means of Positron Emission Tomography (PET). NPs dose per organ will be evaluated from activity curves.