302 Alumina Nanoparticles in Cognitive Ability of Mice Model of Alzheimer's Disease-Bearing Susceptible Genes

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Aluminum (Al) is a vital pathogenic agent responsible for the incidence of neurodegenerative diseases. Our previous work has demonstrated that alumina nanoparticles (NP) have an enhanced capacity to produce reactive oxygen species and consequently have widespread toxic properties. In the present work, we are investigating the cognitive abilities of alumina NP in transgenic (TG) mice bearing susceptible genes of Alzheimer's disease (AD). TG mice bearing arg61, App, Ps1, and Tau were used as the subjects. Mice were randomly divided into 5 groups, which were intranasal treated with 0.9%saline, Alcl3 (Al ion), 50nm-sized alumina NP (Al oxide), 13nm-sized alumina NP, and nanowire alumina (6nm×400nm) at the concentration of 5mg/kg bw. Morris water maze test and open field test were used to detect the cognitive ability of the mice after 8-weeks treatment. The results showed a significant difference in cognitive abilities among the groups. Compared with control, the moved distance, movement and the velocity of Al ion-treated mice reduced significantly, while the mice treated with alumina NP at 50nm, 13nm and nanowire had not shown significance. The cognitive ability of mice treated with Al ion showed its low-dose effect as longer time in the target area and less error, but the mice treated with nano-alumina demonstrated significance size effect, the time in the target area of mice treated with 50nm size alumina decreased, 13nm size extremely decreased, while nanowire no significance. We concluded that alumina NP could induce the decline of the cognitive ability in a size-dependent manner; the trend of effect was significant demonstrated in mice bearing susceptible genes of AD. The present study may establish a path for studying the interaction of metal nanoparticle toxicity with genetic mutations for AD progression.
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303 *In Vivo* Evaluation of the Pulmonary Toxicity of Cellulose Nanocrystals

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Cellulose nanocrystals (CNC), with advantageous chemical and mechanical properties, are viewed as lightweight and inexpensive alternatives to carbon nanotubes (CNTs). Over the past decade, due to their low cost, high abundance and ease of availability, CNC materials have gained prominence in a number of applications: nanofillers in polymer composites, building materials, cosmetics, filtration membranes, photonic films, food, and in the drug industry. Thus, it becomes critical to evaluate the potential health risks associated with CNC exposures. Here, we compared pulmonary outcomes caused by exposure of C57BL/6 mice to two different processed forms of CNC materials, i.e., CNCS (10 wt%; gel/suspension) and CNCP (powder). Pharyngeal aspiration with CNCS and CNCP was found to facilitate the innate inflammatory response assessed by an increase of bronchoalveolar lavage (BAL) leukocytes. Biomarkers of tissue damage were elevated to a higher extent in mice exposed to CNCP. Compared to CNCP, CNCS caused a significant increase in the accumulation of oxidatively modified proteins. The up-regulation of inflammatory cytokines was higher in the lungs after CNCS treatments. Most importantly, the elevated levels of IFN-γ, a Th1 cytokine and IL-13, a Th2 cytokine in the BAL were unique to CNCS and CNCP exposures, respectively. Moreover, CNCP materials were significantly longer than CNCS. Taken together, our data suggests that particle morphology and nanosize dimensions of CNCs may be critical factors affecting the nature of the innate immune inflammatory responses.

304 Green Algae Interacting with Single-Walled Carbon Nanotubes Affect the Feeding Behavior of Mussels, Mitigating Nanotube Toxicity

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With their high aspect ratio, strength, light weight and electrical conductivity single-walled carbon nanotubes (SWCNTs) provide properties of great interest to industry, and, consequently, are finding use in an ever increasing number of products and applications, the increased industrial application of carbon nanotubes has led to a significant interest in their aquatic ecotoxicology and potential for trophic transfer. Green algae (*Tetraselmis suecica*) were exposed in triplicate to 5μg/l, 10μg/l, 50μg/l, 100μg/l and 500μg/l single-walled carbon nanotubes (SWCNTs) for 8 days. The potential for trophic transfer was assessd using the green algae (*Tetraselmis suecica*). Light microscopical observations, confirmed by SEM and Raman spectroscopy, showed that SWCNTs adhered to the external algal cell walls and TEM results suggested internaization. A direct effect of SWCNT exposure on the algae was a significant decrease in chlorophyll a concentrations and cell viability. Algea fed to mussels in the presence of SWCNTs led to a signifiacntly increased pseudofaeces production, suggesting selective feeding. However, histological sections of the mussel digestive gland following exposure showed evidence of SWCNTs containing algal and toxicological tests signs of DNA dmage and oxidative stress. In conclusion, the observed SWCNT-algal interaction may facilitate trophic transfer of SWCNTs up the food chain with potential consequences for human health.

305 Prediction and Comparison of Size-Dependent Biodistribution of Polyethylene Glycol-Coated Gold Nanoparticles in Adult Mice: A Physiologically Based Pharmacokinetic Model

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Nanoparticles (NPs) are widely used in various fields of nanomedicine. A systematic understanding of NP pharmacokinetics is crucial in their design, applications, and risk assessment. In order to integrate experimental information and to gain insights into NP pharmacokinetics, a diffusion-limited physiologically based pharmacokinetic (PBPK) model for polyethylene glycol-coated gold (Au) NPs (PEG-coated AuNPs) was developed in mice. The model described phagocytosis of the NPs in the liver, spleen, kidneys, and lungs and calibrated using data from mice that were intravenously injected with 0.85 mg/kg of 13nm and 100nm PEG-coated AuNPs. This model adequately predicted multiple external datasets for PEG-coated AuNPs of similar sizes (13-20nm; 80-100nm), indicating a reliable prediction for suitable size ranges. Simulation results suggest phagocytosis of NPs is time- and size-dependent, i.e., phagocytosis of larger NPs occurs immediately and directly from the blood, whereas for smaller NPs it is mainly from the tissue and has a 10h delay, which is the primary mechanism responsible for the reported size-dependent pharmacokinetics of NPs. Several physiological parameters (e.g., liver weight fraction of body weight) were identified to have high influence on selected key dose metrics, indicating the need for additional interspecies comparison and scaling studies to conduct pharmacokinetic studies of NPs in animal species that are more closely related to humans with these parameters. This PBPK model provides a solid foundation for extrapolating to other types of NPs and to other species, including humans, to aid in the design and risk assessment of NPs. (This research was supported by the Kansas Bioscience Authority)

306 Realistic Model for Ambient Respiratory Exposure to Nanomaterial Aerosols Using a Deployable *In Vitro* System

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The nanotechnology boom has led to the increasing number of nanomaterials (NMs) being incorporated into industrial processes and consumer products, which has increased the likelihood for significant NM exposure to humans and environ-

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