Safety/Toxicity Assessment of Ceria (a Model Engineered Nanomaterial) to the Brain

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A research team at the Universities of Kentucky and Louisville is investigating the physicochemical (PC) properties of engineered nanoscale materials (ENMs) that influence their uptake into the brain, compared to peripheral organs, and resultant effects on oxidative stress endpoints.

Ceria, a model ENM, is infused into the central venous circulation of rats, enabling the study of its distribution to the brain and other organs from blood, the compartment from which ENMs would distribute after absorption from the lungs, gastrointestinal tract, and across the skin. Initial work with a commercial ceria (Figure) revealed not much toxicity, brain distribution, or effects on oxidative stress endpoints, but considerable agglomeration and some toxicity in reticuloendothelial organs. Results have been presented in several forums (the most recent are Yokel, Florence, Tseng, et al. 2008 and Yokel, Florence, Unrine, et al. 2009), will be presented in upcoming forums, and have been submitted for publication. Recent similarly-conducted studies with a smaller, citrate-surface stabilized, ceria show considerable toxicity and a different pattern of organ accumulation.

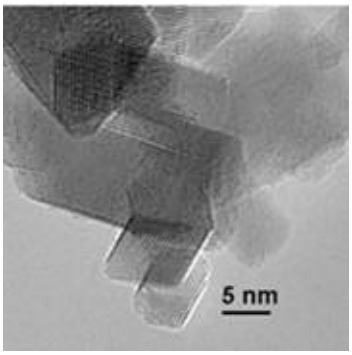

Figure. *Caption*.

These findings show the importance of the PC properties of ENMs on their distribution and effects. The goals are to characterize the important PC properties of ENMs to enable their safe design and use, to capitalize on the massive benefits of ENMs, and minimize their potential to product unwanted adverse effects.

References/Publications

Yokel, R.A., Florence, R.L., Tseng, M.T., Graham, U.M., Sultana, R., Butterfield, D.A., Wu, P., Grulke, E.A. Biodistribution and toxicity of systemically introduced nanoscale ceria. Presention at Nanotoxicology 2nd International Conference, September 7–10, 2008, Zurich, Switzerland.

Yokel, R.A., Florence, R., Unrine, J., Tseng, M.T., Graham, U.M., Sultana, R, Butterfield, D.A., Wu, P., Grulke, E.A. Systemically-introduced nanoscale ceria biodistribution and toxicity. Presented at the Annual Meeting of the Society of Toxicology, March 15-19, 2009, Baltimore, MD.