ichia coli and *Klebsiella* at Statens Serum Institut (Copenhagen, Denmark). Both the sensitivity and specificity were found to be 100%.

Given the high accuracy and great convenience, the new PCR detection method represents an important breakthrough in the molecular diagnosis of hypervirulent *K. pneumoniae*. This new technology provides a highly useful tool for clinical and epidemiological investigations of *K. pneumoniae* and associated diseases.

Reference
Chi-Tai Fang, Yun-Jui Shih, Cheng-Man Cheong, and Wen-Ching Yi. (2016). Rapid and accurate determination of lipopolysaccharide O-antigen types in *Klebsiella pneumoniae* with a novel PCR-based O-genotyping method. *Journal of Clinical Microbiology*, 54, 666-675. DOI: 10.1128/JCM.02494-15.

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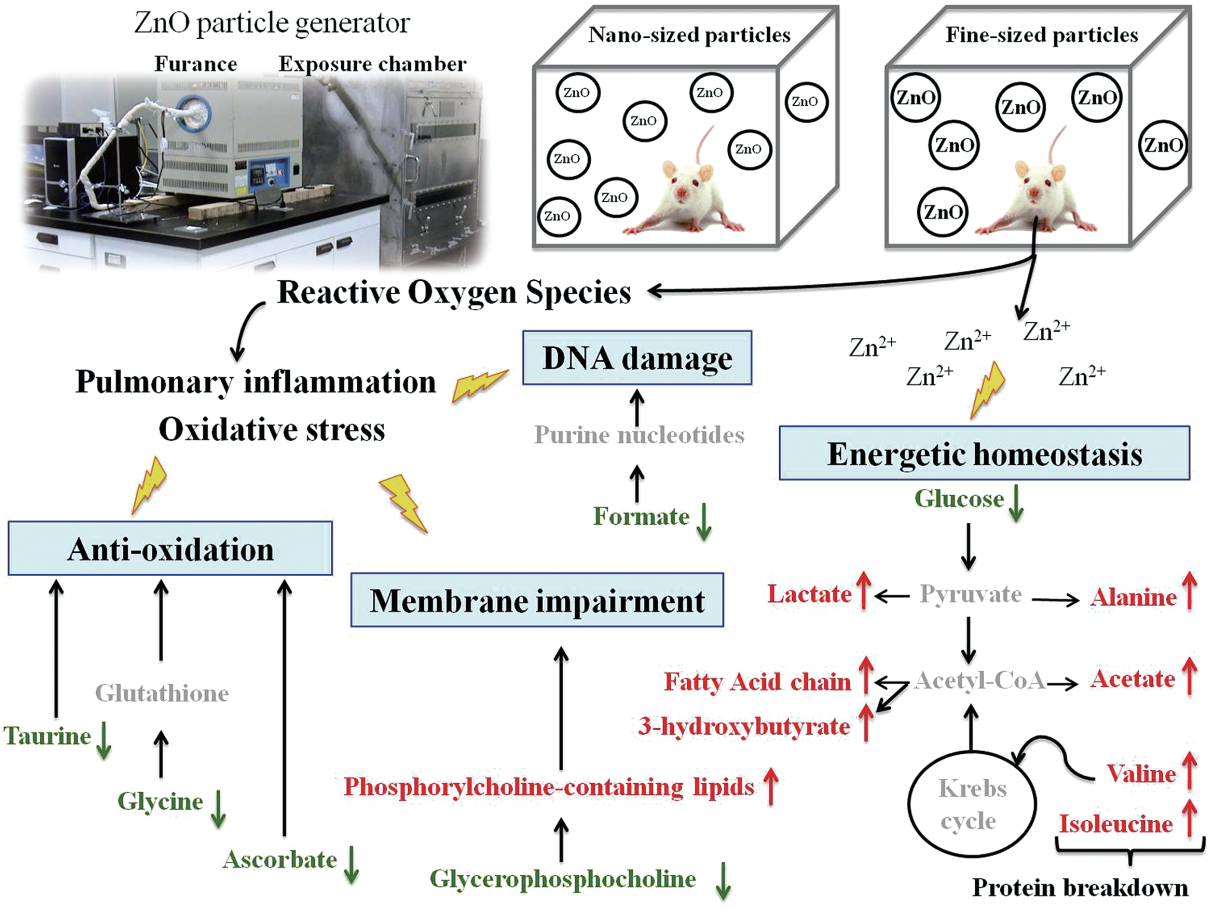
Determining the global metabolic effects of acute inhalation of nano- and fine-sized ZnO particles in the rat lung using an NMR-based metabolomic approach

Nano- and fine-sized zinc oxide (ZnO) particles are widely used for environmental and industrial applications. Previous studies revealed that inhalation of ZnO particles can induce acute occupational inhalation illnesses such as metal fume fever in humans and rats. Although studies have illustrated the association between ZnO-induced adverse effects and pulmonary inflammation, injury, and oxidative stress, the molecular mechanisms in the respiratory system are still unclear. In addition, there is debate regarding the influence of particle size on the toxicity of ZnO particles. Thus, a high-throughput approach was applied to examine the metabolic effects induced by ZnO particles.

This study was published in *Nanotoxicology* in 2016 (10(7): 924–934) and was conducted by Dr. Tsun-Jen Cheng, a professor at the Institute of Occupational Medicine and Industrial Hygiene in the College of Public Health at NTU, Dr. Ching-Yu Lin, an associate professor at the Institute of Environmental Health in the College of Public Health at NTU, and Mr. Sheng-Han Lee, a Ph. D. candidate at the Institute of Environmental Health in the College of Public Health at NTU.

A metabolomic (metabonomic) approach can record a “snapshot” of low-molecular weight metabolites to suggest plausible molecular mechanisms and develop potential biomarkers for different environmental stresses and diseases. To examine the global metabolic responses of the respiratory system of rats that inhaled ZnO particles, a nuclear magnetic resonance (NMR)-based metabolomic approach was used in rats dosed with a series of nano-sized (35 nm) or fine-sized (250 nm) ZnO particles. Bronchoalveolar lavage fluid (BALF) and lung tissues were collected for NMR instrumental analysis and subsequent multivariate statistical analyses such as principal component analysis (PCA) and partial least squares discriminant analysis (PLS-DA).

The results of the PCA and



PLSDA models revealed that the metabolome of the BALF and lung tissues exhibited dose-dependent trends after ZnO particle exposure, especially in the samples from the 250 nm ZnO particle exposure group. In addition, metabolites such as isoleucine, valine, acetate, taurine, glycine, formate, ascorbate, glycerophosphocholine, glucose, phosphorylcholine-containing lipids, fatty acyl chains, and trimethylamine n-oxide were perturbed in the respiratory system, especially in rats exposed to fine-sized ZnO particles. These metabolites are associated with membrane stability, cell anti-oxidation, energy metabolism, and DNA damage. The results suggested plausible molecular mechanisms involved in ZnO particle-induced toxicity. In addition, these results confirmed that the mass is critical regarding the particle size-dependent toxicity of ZnO particles. Because ZnO particle exposure is more concentrated at industrial workplaces, metabolomic approaches can provide more comprehensive knowledge of the *in situ* molecular changes and plausible mechanisms of ZnO particle exposure to assess individual risk. Dr. Lin stated, "Future studies to verify the mechanisms of ZnO-induced toxicity and develop biomarkers will further the knowledge for ZnO risk assessment."

Reference

Sheng-Han Lee, Ting-Yi Wang, Jia-Huei Hong, Tsun-Jen Cheng and Ching-Yu Lin. (2016). NMR-based metabolomics to determine acute inhalation effects of nano- and finesized ZnO particles in the rat lung, *Nanotoxicology*, 10(7), 924-934. DOI: 10.3109/17435390.2016.1144825

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