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Evaluation of fibrogenic effects of carbon nanotubes and potential mechanism using an *in-vitro* approach

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Abstract

Engineered nanomaterials (ENMs), including carbon nanotubes (CNTs) have enormous potential to initiate the next industrial revolution. It is estimated that by 2020, nanotechnology will have a $3 trillion impact on the global economy and employ 6 million workers in the manufacturer of EMN-based products. Far behind the rapid nanotechnology growth, potential adverse health effects of nanoparticles are not known since information is lacking which would allow one to predict the biological activity of these new nanomaterials. For example, certain physicochemical properties of CNT, such as nano-scaled size, aerosolizability, and bio-persistence, raise concerns for respiratory health effects of exposed workers during manufacturing, transportation or usage of CNT-based products. Animal exposure studies show that well dispersed nano-sized CNTs (D-CNTs) can enter the lung interstitium, and induce rapid and progressive interstitial lung fibrosis. We hypothesized that D-CNT, induce a "direct" fibrotic effect by interacting with interstitial cells, such as fibroblasts, at the site of particle accumulation to induce collagen deposition. To test this hypothesis, we studied the effects of D-CNT on cell proliferation and collagen production of cultured human lung fibroblasts. Our results show that D-CNTs have a direct stimulatory effect on fibroblast proliferation and induce collagen production, collagenase (MMP9), TGF-β1 and TGF-β receptor expression of the treated cells. These findings provide new insights into the mechanism of unique CNT-induced lung fibrosis which is different from that of other known fibrosis-inducing micro-sized particles and validate a set of in vitro screening assays to predict the fibrogenic potential of nanoparticles, thus, supporting occupational risk assessment.

Keywords: nanomaterial, carbon nanotubes, lung, exposure, fibrosis.

Biography

Dr. Liying Wang, a Principal Investigator/Research Biologist at National Institute for Occupational Safety and Health (NIOSH) and an adjunct professor in School of Pharmacy and member of Allen Lung Cancer program at Mary Babb Randolph Cancer center, West Virginia University (WVU), USA. After received her Medical Bachelor degree in 1983 from Beijing University-Medical College, China and PhD degree in Department of Microbiology and Immunology, School of Medicine, WVU, USA, she has been working on medical and occupational research such as silicosis, heavy metal toxicology, and occupational nanoparticle-induced lung diseases. Her Cellular Nanotoxicology Lab has been extensively conducting multi-phase research projects to address critical issues in the emerging adverse human health effect of work place particle exposure with more than 70 peer-reviewed publications.