Genotoxicology of Engineered Nanomaterials (ENMs) in human cells

Laura Paesano
University of Parma

Interaction of living organisms with quantum dots (QDs) is certainly more focused on environment and occupational exposure associated with production and release or disposal. Here, the transcription of genes involved in mitochondrial organization and function in HepG2 cells exposed to cadmium sulphide (CdS) QDs has been profiled to highlight biomarkers of exposure and effect to be tested for other cadmium based QDs. At low concentrations, exposure to CdS QDs induced only minor damage to nuclear DNA, and none to mitochondrial DNA. However, the stress caused an increase in the production of reactive oxygen species (ROS), which triggered the mitochondria-mediated intrinsic apoptotic pathway involving a cascade of transcriptomic events, finally prompting the activation of a rescue pathway. The transcriptomic analysis confirmed the involvement in the response to CdS QDs of genes related to apoptosis, oxidative stress response and autophagy, as potential biomarkers. In a cognate study, we followed the effects in HepG2 cell lines of CdS QDs and Cd ions on microRNA levels and mRNA expression profiles. Results showed that only a small number miRNAs (66) were differentially expressed during CdS QDs exposure, whereas 131 miRNAs were altered in their expression by Cd ions. The ultimate goal will be to identify the role of miRNAs in the toxicity mechanism, so as to identify specific miRNAs as reliable biomarkers of CdS QDs exposure.