

Bioinformatic Analysis of Proteomic Changes That Occur in an Airway Epithelial Cell Line in Response to Exposure to Physiologically Relevant Concentrations of Carbon Nanotubes

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Carbon nanomaterials are widely produced and used in industry, medicine and scientific research. To examine the impact of acute exposure to nanoparticles on human health, the human airway epithelial cell line, Calu-3, was used to evaluate potential alterations in cellular function of airway epithelia after 24 hours exposure to different concentrations of two common carbon nanoparticles, single- and multi-wall carbon nanotubes (SWCNT, MWCNT). After exposure to the nanoparticles, label-free quantitative mass spectrometry (LFQMS) was used to study the differential protein expression in Calu-3 cells. Ingenuity Pathway Analysis (IPA) was used to conduct a bioinformatic analysis of proteins identified in LFQMS. Changes in protein abundance generated in response to 100 ng/ml exposure of both MWCNT and SWCNT suggest that cell functions of cell death and survival, cell-to-cell signaling and interaction, cellular assembly and organization, cellular growth and proliferation, infectious disease, molecular transport and protein synthesis are predicted to be effected. The majority of the protein changes represent a decrease in amount suggesting a shut down of metabolism to protect cells. The STRING database was used to analyze the protein networks in different functions. Interestingly some proteins like cadherin 1 (CDH1), signal transducer and activator of transcription 1 (STAT1), junction plakoglobin (JUP), apoptosis-associated speck-like protein containing a CARD (PYCARD), appear in several functions and tend to be in the center of the networks, which suggest they may play important roles in the cell function and activity.

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