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Single-walled carbon nanotubes affect the expression of genes associated with immune response in normal human astrocytes

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Carbon nanotubes (CNTs) have distinctive and remarkable material properties, different from bulk materials with the same chemical composition and potential technological applications, including those in biomedicine [1]. Different variants of CNTs exhibit different toxicity and intratracheal administration of single-walled CNTs (SWCNTs) resulted in inflammation. SWCNTs are able to cross the blood-brain barrier, penetrate through the cell membrane with accumulation in the nucleus via the nuclear pore complex and purposefully allows their use in health sciences as carrier of drugs in cancer therapy and imaging probes [2]. Precise mechanisms of SWCNTs toxicity are still largely unknown and seem to include many pathways. Better understanding of such mechanisms is of importance not only in frame of promising therapeutic applications of carbon nanomaterials, but also required for careful assessment of potential exposure-related risks for human health.

The effect of SWCNTs on the expression of several genes associated with immune response, apoptosis, cell proliferation and transformation in normal human astrocytes line NHA/TS was studied. It was shown that SWCNTs (2, 10 and 50 ng/ml of medium for 24 h) affect the expression of major histocompatibility complex, class II, DR alpha (*HLA-DRA*), a cell surface glycoprotein: slightly up-regulate at 2 ng/ml and strongly down-regulate at 10 and 50 ng/ml. However, the expression of major histocompatibility complex, class I, F (*HLA-F*) and lamin B1 (LMNB1) genes is up-regulated in these cells by different concentrations of SWCNTs. The effect of SWCNTs on the expression of pleckstrin homology-like domain, family A, member 2 (PHLDA2) gene in NHA/TS cells was suppressive and dose-dependent at 10 and 50 ng/ml in 24 h after treatment. At the same time, the effect of SWCNTs on the expression level of procollagen-lysine, 2-oxoglutarate 5-dioxygenase 2 (PLOD2) mRNA in normal human astrocytes does

not change significantly. Thus, SWCNTs dysregulate the expression level of some major histocompatibility complex genes through strong down-regulation of the expression of *HLA-DRA* gene and up-regulation of *HLA-F* gene in normal human astrocytes and possibly contribute to suppression of immune response. The results of this investigation clearly demonstrated that SWCNTs have significant impact on important regulatory mechanisms which control immune response and proliferation and possibly reflect the toxic effect of this unique carbon compound. The results suggest more cautions needed in biomedical applications of SWCNTs.

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