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Epigenetic changes induced by commonly used metal and metal oxide nanoparticles

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Abstract

Nanotechnology is one of the fastest developing fields in science and engineering. Based on market-estimated size and online repositories listing nanoproducts (e.g., Nanodatabase), it is obvious that silver, titanium dioxide and silicon oxide nanoparticles (NPs) are widely used in day-to-day items such as cosmetic and skincare products or clothing materials. However, consumer products containing NPs may become a source of air pollution, raising concerns regarding human health. Toxic effects of NPs are relatively well documented, although experimental data regarding epigenetic alterations is limited. Our review study aims to provide a general description of the epigenetic changes induced by these three commonly used NP types. We considered recent *in vivo* and *in vitro* studies and discussed which molecular pathways associated with DNA methylation and histone post-translational modifications were impaired by NPs exposure. Knowledge gaps related to the subject were also highlighted. Our work could contribute to the improvement of knowledge about NPs toxicity by compiling the related data available so far and clearly illustrating general NPs effects observed on key molecules from epigenetic signalling pathways. Epigenetic changes play a crucial role in triggering different human disorders. Considering the widespread of NPs, all their toxic effects, including epigenetic impairment, need to be documented to completely assess their safety. We concluded exposure to NPs affects genes involved in establishing and maintaining the normal epigenetic pattern. It remains unknown whether epigenetic changes occur as an indirect consequence of other NPs toxic effects such as oxidative stress and inflammation. These data may be considered in developing appropriate public policies for nanomaterials market.

Keywords: DNA methylation, histone modification, epigenetic, nanoparticle.

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