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Adverse Effects of TiO_2 Nanoparticles on Human Dermal Fibroblasts and How to Protect Cells ZHI PAN, WILSON LEE, LENNY SLUTSKY, Stony Brook University, SOWMYA SANDARESH, Hicksville High School, NICOLE ELSTEIN, Bayport-Bluepoint High School, RICHARD CLARK, NADINE PERNODET, MIRIAM RAFAILOVICH, Stony Brook University — We have studied the effects of exposure of human dermal fibroblasts to rutile and anatase TiO_2 nanoparticles. We found that these particles can impair cell functions, with the latter being more potent at producing damage. We showed that the exposure to nanoparticles decreases cell area, cell proliferation, mobility, and ability to contract collagen. Individual particles are shown to penetrate easily through the cell membrane, in the absence of endocytosis, while some endocytosis is observed for larger particle clusters. Once inside, the particles are sequestered in vesicles, which continue to fill up with increasing incubation time till they rupture. We also tested particles that were coated with a dense grafted polymer brush and, using flow cytometry, showed that the coating prevented the particles from adhering to the cell membrane and hence penetrating the cell, which effectively decreases reactive oxygen species (ROS) formation and protects cells, even in the absence of light exposure. Considering the broad applications of these nanoparticles in personal health care products, the functionalized polymer coating can potentially play an important role in protecting cells and tissue from damage.

Miriam Rafailovich
Stony Brook University

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