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Different electron structures of Pristine CeO_2 mediates distinct human Neural Progenitor cell survival and Neuronal differentiation

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The survival rate and neural differentiation of after cell transplantation is a huge challenge for neural progenitor cells (NPCs) therapy, a promising therapeutic strategy for neurodegeneration diseases. Reactive oxygen species (ROS) also plays a critical role as signaling molecule for numerous biological processes, including cell differentiation, proliferation and apoptosis. Recently, cerium oxide (CeO2) nanoparticles have been reported for multi-enzyme mimetic activities like that of peroxidase and catalase, and shown to modulate oxidative stress in several neurodegenerative diseases. Although CeO2-based nanozymes has been reported with catalase (CAT)-like activity, the role of its crystal facet is still unclear. In this study, the CeO2 in the shape of cube, rod, octahedron with different facets are prepared and the different antioxidant effect as well as the differentiation on ReNcell CX immortalized human neural progenitor cells are determined. Detailed data shows that the CeO2 nanoshapes are biocompatible for ReNcell CX immortalized human NPCs. In which, the cube (100), with the highest electron density and the highest CAT-like activity, exhibit the best effect on protection NPCs from oxidative stress induced by H2O2. While, the octahedron (111) is most effective to promote the differentiation of ReNcell CX cells into neurons. Our findings clarify the facet-dependent biological effect (e.g. CAT-like activity and enhancement of stem cell differentiation) and might provide a new scientific basis for CeO2 used in stem cell therapy based on the facet-dependent physiochemical properties and catalytic activity.

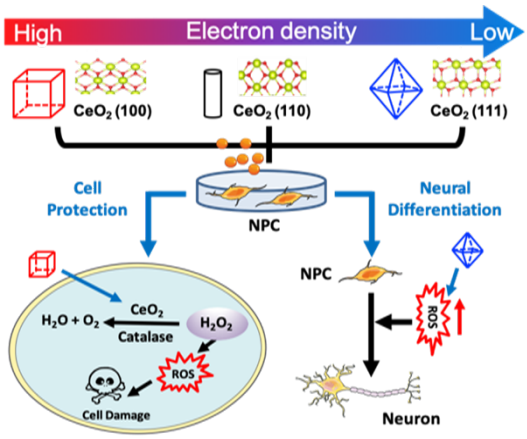

Figure. Effects of facet-dependent CeO_2 nanoparticles on the human neural progenitor cells proliferation under oxidative stress induced by H_2O_2 and differentiation.

Recent Publication

1. Kaili Lin, Zhang Zhang, Ying Wang et al. Oleanolic Acid Alleviates Cerebral Ischemia/Reperfusion Injury via Regulation of the GSK-3β/HO-1 Signaling Pathway. Pharmaceuticals. 2022.15:1.
2. Shiqing Zhang, Xiaoli Jiang, Ying Wang et al. Protective Effect of An-Gong-Niu-Huang Wan Pre-treatment Against Experimental Cerebral Ischemia Injury via Regulating GSK-3β/HO-1 Pathway. Front Pharmacol. 2021, 12:640297.
3. Ying Wang, Mei Zhang, Li Ruijin et al. Fine particulate matter induces mitochondrial dysfunction and oxidative stress in human SH-SY5Y cells. Chemosphere, 2019, 218,577-588.

Biography

Ying Wang received the B.S. degree of Resources Environment and the Management of Urban and Rural Planning from Shanxi University of Finance and Economics in 2016 and the M.S. degree of Environmental Science in 2019. She is currently working toward the Ph.D. degree of Biology at the Hong Kong Baptist University. Her research focuses on exploring possible nanotechnology in neural stem cell therapy by studying the effects of potential nanomaterials with different physicochemical properties on neural stem cells, and provide a new scientific basis for nanomaterials used in stem cell therapy based on the shape-dependent and chirality-dependent properties.

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