Investigation of cytotoxic effects of different ZnO nanostructures on living cancer cells

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# Investigation of cytotoxic effects of different ZnO nanostructures on living cancer cells

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Thanks to its intrinsic and unique physico-chemical properties, in recent years the use of zinc oxide (ZnO) has increased for applications in different fields, from biosensing to cancer therapy. Besides, ZnO is known to be a versatile material, easy to synthesize in different shapes and sizes, as nanowires and nanoparticles [1]. Those nanostructures can be in turn effortlessly functionalized with many types of chemical molecules, in order to improve their bioavailability and related functionalities. Obviously, their dimensions as well as the possible presence of surface functional groups can dramatically modify their behavior in a biological context, as living cell culture, and the understanding of these mechanisms is still crucial for exploiting ZnO nanostructures as therapeutic and/or diagnostic agents [2]. In this study the cytotoxic behavior of different ZnO nanostructures was *in vitro* evaluated analyzing the long-term responses (until 72 hours) of the tumor KB cell line (human oral carcinoma). Cells were cultured with different concentrations of bare ZnO nanoparticles (ZnO NPs) and nanowires (ZnO NWs), and amino-propyl functionalized ZnO nanoparticles (ZnO-$NH_2$ NPs) [3]. We directly imaged the ZnO-$NH_2$ NPs and ZnO NWs cytotoxic effect through transmission electron microscopy (TEM), even if without getting a clearly evidence of their presence and localization into the cells, due to both their low amount and size. Our results demonstrate however that the different morphology and surface functionalization of ZnO nanostructures could differently affect the cell growth. In particular, an apparent viability decrease of cells treated with ZnO NWs was observed, and TEM analyses also showed that both ZnO NPs and ZnO NWs could generate severe damages in KB cells just after 5 hours of incubation. Conversely, the presence of the ZnO NPs surface functionalized with aminopropyl groups looked mitigating the cytotoxic effect more clearly than what observed with bare ZnO NPs.

[1] P. Zhu, Z. Weng, X. Li, X. Liu, S. Wu , K.Yeung, X. Wang, Z. Cui, X. Yang and P. Chu, *Adv. Mater. Interfaces 3* **1** (2016) 1-30
[2] J. Rasmussen, E. Martinez, P. Louka and D. Wingett, *Expert Opin Drug Deliv* **7** (2010) 1063-1077
[3] V. Cauda, R. Gazia, S. Porro, S. Stassi, G. Canavese, I. Roppolo, and A. Chiolerio**, "**Handbook of Nanomaterial Properties. XXVII" 1464 pages, Springer Verlag, Berlin Heidelberg, 2014.