The interactions between nanoparticles and cells via first host defense system

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BACKGROUND: As the amount of engineered nanomaterials (ENMs) has risen abruptly in recent decades, cells may not have had enough time to establish a specific defense system for those foreign objects. Therefore innate defense responses, including innate immune response, environmental stress response or DNA damage response could be temporarily used to protect the cell itself from stimulation by ENMs. We named this defense response as "First Host Defense System" (FHDS). Studies concerning the FHDS would be important for ENMs' nanotoxicological investigation.

METHODOLOGY: Three sensor cells were established using promoter-reporter plasmids, which are sensitive to changes in relative promoter activation in response to 1) cellular inflammatory response, 2) cellular protein denaturation response or 3) DNA damage response. After successfully prepared the sensor cells, the three kinds of sensor cells were employed to detect the TiO_2 NPs induced FHDS.



Figure 1 The illustration of interaction between NPs and cells. The sensor cells detected the protein denaturation response induced by TiO_2 NPs. The sensor cells using NF- κ B promoter and TLR4 could detect the cellular inflammatory induced by TiO_2 NPs. The sensor cells also showed that TiO_2 NPs could induce high DNA damage.

PRINCIPAL FINDINGS: It was demonstrated that TiO_2 NPs stimulated FHDS response successfully detected by our designed sensor cells. The results indicated that these sensor cells could detect the interactions between nanomaterials and cells (Fig.1) and these sensor cells could be used for nanomaterial detection and safety evaluation to promote environmental and human health.

Reference:

[1] A. Taniguchi, *Biomaterials*, 31, 5911-5915 (2010).