Uptake kinetics of polystyrene nanoparticles in CD34$^+$ hematopoietic stem cells and CD34+-derived dendritic cells

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Nanomaterials offer great opportunities for innovation and technological development, but increased use also implies increased human exposure and an augmented potential health impact. Manufactured nanoparticles (NPs) have unique physico-chemical properties and surface moieties that generate an ability to interact with cells, proteins and DNA at a molecular level, and modulate the immune system by novel mechanisms. Resulting derangement of the developing immune system can lead to immune suppression, but more importantly to increases in the incidence or severity of allergic and autoimmune diseases. To study the potential impact of NPs in immune system development it is important to understand whether and how NPs are taken up by the cell type studied.

In this study we used cord blood-derived CD34$^+$ hematopoietic stem cells (HSC) that can develop into a variety of immune cells through subsequent steps of proliferation and differentiation. Additionally *in vitro* HSC-derived myeloid-type dendritic cells (DC) were used as a relevant cell model, since disturbance of DC differentiation can lead to a skewed Th1/Th2 balance later in life [1].
The cells were exposed to a monodisperse suspension of 40 nm fluorescently labeled polystyrene NPs. Uptake kinetics were evaluated by monitoring NP uptake every hour, during 6 hours, using flow cytometry.
Both DC and HSC were shown to take up the majority of the NPs within the first hour. Thereafter the uptake kinetics diverged between the two cell models, suggesting different uptake mechanisms and fate of the NPs within the cells. Future experiments will aim to gain further insights into these aspects, which will be exploited to elucidate the possible interference of NPs with normal cell function.

References

[1] Koga Y, Matsuzaki A, Suminoe A, et al. Immunol Lett **116** (2008) 55-63.