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An epithelial airway model to visualize cellular interplay after nanoparticle exposure

A number of epidemiological studies give evidence that inhalation of fine particles (0.1-2.5µm) and nano-particles (<0.1µm) cause increased pulmonary morbidity and mortality. A series of barriers protect the respiratory system against harmful and innocuous particulate material. Yet, it is still not clear how the antigen presenting dendritic cells (DCs) located in or at the base of the airway epithelium take up inhaled antigens and how macrophages on top of the epithelium may collaborate.

Using laser scanning microscopy and digital image restoration we visualized in a triple cell co-culture model composed of epithelial cells (A549 or 16HBE14o cells), airway macrophages (AMs) and DCs that DCs make processes between the epithelial cells through the tight junctions or migrate through the epithelium towards the “luminal side” to capture deposited particles on the epithelial surface, interact with particle loaded AMs or other DCs to take up particles, and that AMs containing particles form interepithelial processes towards the base of the epithelium.

DCs and AMs acting as sentinels against foreign particulate antigen appeared to build a transepithelial interacting cellular network. This *in vitro* system and the visualization technique allowed us to gain new insights into airway epithelial defence mechanisms after the deposition of particulate matter.

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