A three-dimensional cellular model of the human respiratory tract to study the interaction with particles

Rothen-Rutishauser, Barbara M.; Kiama, S G; Gehr, Peter

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Abstract

A novel triple co-culture model of the human airway barrier was designed to simulate the cellular part of the air–blood barrier of the respiratory tract represented by macrophages, epithelial cells, and dendritic cells. When epithelial cells (A549 cells) were grown on filter inserts with pores of 3.0 m in diameter in a two-chamber system, they formed monolayers with polarization into apical and basolateral domains. The epithelial cell cultures were then supplemented with human blood monocyte–derived macrophages and dendritic cells on the apical and basal aspect, respectively. The single-cell cultures as well as the triple co-cultures were characterized in terms of a number of typical features, for example, morphology of cell types, integrity of epithelial layer, and expression of specific cell surface markers (CD14 for macrophages and CD86 for dendritic cells). The interplay of epithelial cells with macrophages and dendritic cells during the uptake of polystyrene particles (1 m in diameter) was investigated with confocal laser scanning and conventional transmission electron microscopy. Particles were found in all three cell types, although dendritic cells were not directly exposed to the particles. More investigations are needed to understand the translocation pathway