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Uptake of grass pollen allergens by epithelial cells

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Background: Epithelial cells of the respiratory tract and the dermis form a tight barrier against environmental harm. Consequently, they constitute the first exposure point of airborne allergen-carriers. In order to activate resident immune cells which then initiate a type I allergic reaction allergens first have to cross the epithelial barrier.

Objective: The aim of this study was to analyse the uptake of isolated major allergens from timothy grass pollen by epithelial cells: the group 1 allergen Phl p 1 as a protein with glycosylations and disulfide bridges and the group 6 allergen Phl p 6 lacking posttranslational modifications.

Methods: As models of respiratory tract and dermal epithelia the A549 cell line and primary human keratinocytes were used, respectively. The isolated allergens were labelled with fluorescent dyes and the uptake was analysed by flow cytometry. The intracellular localisation was determined by confocal microscopy.

Results: The uptake of allergens by A549 cells occurred rapidly and remained constant over 2–24 h. Both allergens were localised intracellularly in vesicles. Since only a small fraction of these vesicles displays an acidic pH, this might indicate that most of the allergens were intact and not processed in the lysosomal compartment. Additionally, the allergens were exocytosed by the A549 cells indicating a transcytosis mechanism for allergens to pass the respiratory epithelial barrier. Like the A549 cells, keratinocytes internalised the allergens, but the uptake was increased constantly with a maximum after 24 h. To study allergen uptake under inflammatory conditions, keratinocytes were treated with IFN γ prior to allergen exposure. IFN γ -stimulated keratinocytes showed a significantly enhanced internalisation of both allergens.

Conclusion: In this study we show clear differences between respiratory and dermal epithelial cells in the uptake of pollen allergens indicating distinct mechanisms of allergen uptake and processing in the epithelia examined. Furthermore, the increased allergen uptake by keratinocytes under inflammatory conditions may play an important role in the pathomechanism of transepidermal sensitisation during inflammatory skin reaction such as atopic dermatitis.