

Role of pollen-derived reactive oxygen species (ROS) in allergic inflammation

It has been demonstrated that allergic airway inflammation and asthma is associated with oxidative stress. The mechanisms that had been described for induction of oxidative stress in asthma include ROS generated by inflammatory cells recruited to the airways in response to allergen exposure, and ROS induced by exposure to such environmental pollutants as ozone and cigarette smoke. We have discovered a novel characteristic of pollen grains, which may play an important role in the pathogenesis of allergic diseases (Boldogh et al. 2005). We have demonstrated that pollen grains (Bacsi et al. 2005), their allergenic extracts (Boldogh et al. 2005) and subpollen particles (Bacsi et al. 2006) have a potent pro-oxidant activity, which induces profound oxidative stress in the lung or conjunctiva within minutes after exposure, and is independent of adaptive immunity (Boldogh et al. 2005). Inhibition of this immediate oxidative insult dramatically decreases the immediate-type hypersensitivity reactions and inflammatory cell infiltration into the conjunctiva (Bacsi et al. 2005), as well as allergen-induced mucin production, and the perivascular and peribronchial accumulation of inflammatory cells in sensitized mice after pollen challenge (Dharajiya et al. 2007). We also demonstrated that the remarkable pro-oxidant effect of pollen grains, pollen extracts and subpollen particles is due to the activity of NAD(P)H oxidases. These enzymes interact with molecular oxygen and initiate the generation of various reactive oxygen radicals that induce oxidative damage to macromolecules in the epithelium. Furthermore, we have also demonstrated that the oxidative stress generated by the pollen grains' and subpollen particles' NAD(P)H oxidase activity possesses a pivotal role in activation of dendritic cells (DCs), hereby it contributes to the initiation of adaptive immune responses against innocuous pollen proteins (Csillag et al. 2010; Pazmandi et al. 2012).