

# Short-term Exposure to Nanoplastic – containing Aerosol Causes Immunomodulation in Healthy Human Primary Airway Epithelium

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**Introduction:** As an environmental pollutant, nano-plastics (NP) have been detected in ocean and freshwater ecosystems. NPs are used in a variety of commercial and industrial processes, and larger plastics released into the environment will inevitably break down into NPs. Recent evidence suggests that NP particles become airborne in aerosols generated by natural water body motion. Occupational exposure to various NPs suggest airway irritation, neutrophilic inflammation, translocation, increased risk of lung carcinoma and chronic respiratory disease such as asthma, and even respiratory failure.

**Objectives:** Determine how a 3-dimensional cell culture model of airway epithelial cells responds to aerosolized NP particles.

**Methods:** A 3-dimensional cell culture model was constructed using cells pooled from 14 donor patients using a 24 well plate transwell insert format. Each set of cells was exposed to nanoplastic aerosol (2.5% w/v, 0.05  $\mu\text{m}$  mean diameter) or vehicle for 3 minutes per exposure, 3 exposures per day, for 3 days total. Tissue integrity, mucociliary clearance, protein secretion, and chemoattractant potential were all measured post exposure.

**Results:** No changes to tissue integrity or mucociliary clearance were detected after exposure. However, protein secretion of IL-21, IL-2, IL-15, CXCL10, and TGF $\beta$  were all significantly decreased after exposure to NP-containing aerosol vs. control (all  $p < 0.05$ ), while MIP-1a showed a significantly higher secretion from the NP-containing aerosol exposed cells vs. control ( $p < 0.05$ ). Additionally, a Boyden

Chamber assay revealed that aerosol exposed cells caused a significantly higher migration of neutrophils.

**Conclusion:** Aerosolized micro- and nanoplastics are a potential threat to human health, inducing immunomodulatory effects even after short term exposures in healthy human airway epithelium. Those living in areas with high levels of pollution, and those with pre-existing conditions may be at higher risk for inhalation toxicity, which warrants further study.