Mechanisms of damage formation and its regeneration caused by particulate matter and microplastics from air pollution in a model of acute and chronic lung injury.

Environmental pollution is an important element affecting the public health. In areas with high population density most of air pollutants are generated during combustion of plant biomass and coal, which are the most important energy source used to heat homes. Diesel exhaust particles are another source of air pollution. Recently, it was shown that microplastic fibres are present in the air and are inhaled and accumulated in the lungs. A significant association between increased levels of air pollution and elevated risk of mortality and morbidity, especially in people with pre-existing lung diseases has been demonstrated.

The airway epithelium is the first point of contact in the in respiratory tract for inhaled material, including infectious pathogens and particulate matter (PM). The respiratory epithelium protects against the toxicity of inhaled factors by many functional mechanisms e.g., by trapping and clearance via the mucociliary escalator, presence of a protective barrier with tight junctions and initiation of a local inflammatory response. The epithelium after acute or chronic injury repairs and regenerates to restore its functions. The chronic exposition to noxious factors, repair processes are either insufficient or impaired. This results in cumulative damage to the alveolar compartment and subsequently reduced diffusion capacity and lung function.

In this project we will assess the impact of urban particulate matter and microplastisc on biological processes associated with bronchial epithelial damages in *in vitro* model of acute and chronic lung injury.

To realize this goal the 3D *in vitro* model of acute and chronic epithelial injury will be incorporated with macrophage/bronchial epithelial cells co-cultures. These models will be physically wounded by scratching, and cell regenerative proprieties will be evaluated in cultures after PM and microplastic exposition.

We suspect that toxic effects of air pollution are correlated with structural changes of airway epithelium therefore the healing of the epithelial damages caused by components of air pollution is different during acute and chronic lung injury. The structural impairment of airway epithelium caused by chronic lung injury might increase the permeability and toxic effect of PM and microplastisc. The results of our study might help in fully understanding the substantial processes associated with air pollution toxicity and its impact on healthy and impaired epithelium. The knowledge of exact processes affected by particles associated with PM emission in respiratory epithelium is an important issue due to possible therapeutic application especially in areas where people are chronic exposed to air pollution. We are confident that the results of this project will contribute to a better understanding of the impact of environmental pollution on pathobiology of chronic lung diseases.