Asthma and chronic obstructive pulmonary disease (COPD) are the most common chronic respiratory diseases in our population. Both diseases are characterized by inflammation in the lower airways which leads to airflow limitation. Dyspnea, wheezing, cough (dry as well as productive) and exercise intolerance are typical for asthma and COPD. Genes play a significant role in both diseases, but environmental factors such as allergens which increase the risk of asthma and tobacco exposure which is the main cause of COPD are also of great importance. Asthma and COPD are complex diseases with a highly variable clinical course. Diagnosis of asthma and COPD may be difficult because these diseases are sometimes manifested by very similar symptoms. In practice, asthma and COPD are often two sets of airways disease, which pathophysiology, clinical symptoms and treatment significantly overlap. One of the main factors which determine the development and the course of asthma and COPD is the influx of various inflammatory cells into the airways. The predominance and activity of certain populations of these cells are strictly associated with symptoms of the disease. Asthma is typically related with the presence of eosinophils, while neutrophils are the main cells responsible for the development of COPD. However, the classical picture of airway inflammation attributed to asthma or COPD is often difficult to observe, because many mixed and overlapped phenotypes of the disease.The increased number of eosinophils and neutrophils in the lungs result in the release of toxic mediators that cause local damage and disease symptoms. In addition, eosinophils and neutrophils produce many harmful proteins, both by themselves or in cooperation with other cells. These cells form a complex network which regulates airway inflammation and is related with mucus overproduction and irritation of the nerve endings. This leads to cough, shortness of breath, decreased values of lung function indices and an increased risk of respiratory infections.

The cells in the respiratory system have the ability to communicate. Their influx to the airways and the lungs is regulated by many mediators. TSLP, IL-33 and IL-25 - cytokines produced by respiratory epithelium are the important signal proteins which determinate allergic response through creation of a positive feedback loop between airway epithelium and inflammatory cells infiltrating the airways. The role of TSLP, IL-33 and IL-25 is conventionally attributed to asthma, as a disease frequently related to allergy dependent background. The meaning and function of TSLP, IL-33 and IL-25 in COPD is not known. Atopy is a genetically determined distress syndrome of the immune system arising from the body's reaction to an allergen involves TSLP, IL-33 and IL-25. In light of recent scientific publications which emphasize the personalization of diagnosis and treatment of obstructive diseases, it is important to know the origin of allergic reactions that can occur both in asthma and COPD and especially in COPD with allergy phenotype (eosinophilic COPD).

The presented project is aimed to employ approaches in order to verify the interaction and dependency between the main effector immunology cells: macrophages, respiratory epithelium and dendritic cells in the expression of TSLP, IL-33 and IL-25 in atopic and non-atopic obstructive lung diseases. The project will be realized in a complex, advanced triple co-culture in vitro model which reflects the functional and active place of immunological response in human airways. The airway epithelial cells will be isolated from nasal brushing specimen, macrophages and dendritic cells will be isolated from peripheral blood mononuclear cells from asthma, COPD patients and healthy volunteers.

A detailed characterization of biochemical reactions which determinates allergic inflammation in obstructive lung diseases will add a new knowledge to the field of immunology and elucidate the mechanisms underlying asthma and COPD and regulating the course of these diseases.