In this issue of the *Journal of Innate Immunity*, several articles dealing with innate immune responses and inflammation in the airways are presented. Some of the cellular players involved are known for a long time. Early discoveries were made by Paul Ehrlich (1854–1915) who, together with Elie Metchnikoff (1845–1916), is recognized as the founder of innate immunity. In their review, Valent et al. [1] describe the life and career of this outstanding scientist. An example of Paul Ehrlich’s discoveries is the use of eosin, a bright red dye that stains cationic proteins due to its acidic nature, on cells and tissues. He introduced the term ‘eosinophil’ to describe these unique cells with granules (which he called α-granules) showing an affinity for this dye.

The presence of eosinophils is a hallmark of allergic asthma, and eosinophil levels are also typically raised in the blood and tissue during helminthic infestation. However, despite many years of research, their role in allergic inflammation is still not elucidated [2]. During airway inflammation, initial innate immune responses can be divided into a sequence of events where resolution is important [3]. A prolonged and systemic inflammatory response may affect local host defense, resulting from decreased granulocyte activation as well as the production of reactive oxygen species (ROS) [4, 5]. After ROS recruitment to the site of inflammation, where CXC chemokines play an essential role, ROS production is an important arm of innate host defense executed by neutrophils [6]. In this issue, Choudhary et al. [7] show that endogenous nuclear ROS sensors transmit nuclear signals that coordinate outside-in pattern recognition receptor signaling, regulating innate immune receptors and thereby playing important roles in the control of pulmonary innate immunity.

Chronic obstructive pulmonary disease (COPD) will soon become one of the most important causes of morbidity and mortality worldwide [8]. Thus, in this disease, the roles of innate immune mechanisms are important and attract increasing attention. Chronic bacterial infections of the lower airways are common in COPD, and it was reported that altered structures in the lower respiratory tract present habitats for commensals such as *Moraxella catarrhalis* [9]. The dysregulated host defense is a major player in COPD and, in recent years, innate sensing of pathogens and inflammasome activation have caught increased interest [10–14].

Cystic fibrosis (CF) is a genetic disease sharing several similarities with COPD, i.e. a persistent neutrophil-dominated inflammation of the airways often in combination with chronic infection [15]. Neutrophils accumulate and,
as a result, DNA is abundant within the bronchi. Part of the DNA is attributed to the formation of neutrophil extracellular traps, a process that is subject to complex regulation [16, 17]. Recently, bactericidal activity of extracellular DNA against Pseudomonas aeruginosa, a common respiratory pathogen in CF, was described [18]. Antimicrobial proteins bound to neutrophil extracellular traps may have several roles, including antimicrobial activity, and they also protect these structures against degradation induced by bacterial nucleases [19]. It is exciting to see that novel roles for extracellular DNA in the airways can continue to be unraveled.

The last article in this issue by Benedyk et al. [20] demonstrates the importance of Porphyromonas gingivalis and its proteases in the development of aspiration pneumonia. Even if this state of disease is not associated with chronic inflammation, the model presented shows how rapid the delicate environment of the lower airways can be devastated by invading bacteria.

Taken together, the delicate tuning of airway innate immunity is continuously challenged by the environment and is skewed during prolonged inflammation, as seen in asthma, CF and COPD. Many questions remain to be answered in this rapidly evolving field of research.

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References


