

Editorial

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Emerging role of microRNAs in allergic diseases

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The prevalence of allergic diseases has risen at alarming rates, and a recent study identified allergic sensitization in 40% of school children worldwide^[1]. Allergic diseases affect a wide variety of organs, including eyes (allergic conjunctivitis), nose (allergic rhinitis), airway (asthma), gastrointestinal tract (food allergies and eosinophilic esophagitis), and skin (atopic dermatitis). Common gaps among these diseases are the lack of understanding of the molecular basis of pathogenesis (particularly how and why inflammation is de-regulated), and the crucial need to identify biomarkers to better diagnose and characterize these diseases. Along these lines, microRNAs (miRNAs) have emerged as central regulators of many processes (including inflammation) and potentially useful biomarkers (in large part because they are found in all biofluids). As a result, it is not surprising that these two fields have intersected, and a better understanding of how miRNAs regulate allergic inflammation could lead to novel therapies and diagnostic tools.

We are just beginning to understand the roles of miRNAs in allergic diseases. This special issue highlights the emerging roles of miRNAs in across a spectrum of allergic disease that affects different organ systems, and demonstrates their potential application to understanding, treating, and diagnosing human disease. The article by Weidner *et al.*^[2] reviews the progress in our understanding of miRNAs in asthma, and the evolution of research from mouse to humans. This review captures the translational research potential of miRNAs in asthma, and underscores the need for both mouse and human studies in mechanistic miRNA studies. In particular, ablation of pathogenic miRNAs (such as miR-155) in mice has demonstrated their crucial role in pathogenesis of allergic inflammation, and their conserved role in human disease is now becoming evident. In work from our lab, Zhang *et al.*^[3] present a primary research article that builds on the mechanistic studies to show how miRNAs can be used to better characterize asthma. We now understand that asthma is a syndrome that is comprised of many distinct phenotypes, which have different molecular



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causes and respond differently to medications. There is a lack of biomarkers to categorize patients into these phenotypes, which hampers our ability to effectively diagnose and treat asthma. Our work demonstrated that blood miRNAs are capable of objectively categorizing patients in different phenotypes, which may tell us about the molecular mechanisms of these forms of asthma and allow us to better tailor treatment for each patient (personalized therapy)^[3]. It is interesting to note that many of the miRNAs discussed by Weidner *et al.*^[2] were candidates we identified in the biomarker study, indicating that these are functional biomarkers that may also serve as therapeutic targets.

The article by Bhardwaj further extends the miRNA research to atopic dermatitis, an allergic skin disease^[4]. Many of the asthma candidate miRNAs emerged as players in the pathogenesis of atopic dermatitis, suggesting that miRNA pathways may be de-regulated in the skin in an analogous manner to the airways in asthma. Along these lines, Lambert *et al.*^[5] reviewed the current literature on miRNAs in eosinophilic esophagitis, a relatively new disease whose pathogenesis is poorly characterized. A panel of miRNAs was found to be de-regulated in inflamed esophageal tissue, and mechanistic studies suggest that they regulate allergic cytokine signaling. Together, these studies demonstrate the potential importance of miRNAs as pathogenic mediators and biomarkers of allergic disease. Translational approaches using mouse models and humans have produced findings that have direct clinical relevance. Many miRNAs were implicated in common across organ-specific allergic diseases, suggesting that targeting them for therapeutics could present a strategy to treat a broad spectrum of allergic diseases.

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