THE PHYSICS OF ASTHMA

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ABSTRACT

Asthma is a syndrome that is diagnosed on the basis of symptoms that represent the common clinical phenotype of a number of different disease processes. Key among these symptoms is airways hyperresponsiveness whereby the mechanical behavior of the lungs become excessively deranged following inhalation of a standard dose of smooth muscle agonist (usually methacholine). The pathogenesis of airways hyperresponsiveness is still controversial because it can potentially be explained by a number of disparate mechanisms including excessive force generation and shortening of the airway smooth muscle, inflammatory thickening of the airway wall, excessive secretions that occlude the airway lumen, and altered transport of the inhaled agonist to the smooth muscle. All these factors involve physical processes that can be described mathematically. Computational models fit to measurements of lung function in both animal models of asthma and human asthmatic patients will be discussed. These models manifest over a range of length scale from isolated smooth muscle tissue up to the entire airway tree.

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