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Modeling and measurements of dispersion in a multi-generational model of the human airways[1] FRANK FRESCONI, AJAY PRASAD, Department of Mechanical Engineering, University of Delaware, Newark, DE 19716 — A detailed knowledge of the flow and dispersion within the human respiratory tract is desirable for numerous reasons. Both risk assessments of exposure to toxic particles in the environment, and the design of medical delivery systems targeting both lung-specific conditions (asthma, cystic fibrosis, and chronic obstructive pulmonary disease) and system-wide ailments (diabetes, cancer, hormone replacement) would profit from such an understanding. The present work features both theoretical and experimental efforts aimed at elucidating the fluid mechanics of the lung. Steady streaming due to dissimilar velocity profiles between inspiration and expiration is addressed theoretically. This model employs a parameterized velocity profile to determine the effect on mass transport in the limit of no mixing and full mixing in the cross-section. Particle image velocimetry and laser induced fluorescence measurements of oscillatory flows in anatomically accurate models (single and multi-generational) of the conductive region of the lung illustrate pertinent flow features. Results are interpreted in the light of physiological applications.

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