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Lagrangian dispersion in the bronchial tree characterized by Magnetic Resonance Velocimetry.[1] SAHAR JALAL, OMID AMILI, FILIPPO COLETTI, University of Minnesota, Twin Cities — The bronchial tree is a complex network whose transport properties are inherently challenging to model, especially because of its multi-scale nature. Most previous studies in this area have followed an Eulerian perspective, characterizing the velocity and/or scalar field within ventilated airways, or documenting the concentration of inhaled particles upon deposition on the walls. In the present study we investigate the Lagrangian dispersion in the central human airways, performing Magnetic Resonance Velocimetry (MRV) in 3D-printed replicas of idealized and realistic bronchial trees. We obtain three-dimensional, three-component velocity fields during the ventilation cycle, and reconstruct the trajectories of virtually released mass-less and inertial particles. We consider both steady inhalation (relevant to drug delivery) and high-frequency ventilation (a common technique of mechanical ventilatory support). This approach allows us to characterize the transport properties of the airway tree and other biological flow systems, leveraging tools commonly used in turbulent and porous media flows.

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