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Steady Flow in Subject-Specific Human Airways from Mouth to Sixth Bronchial Generation ANDREW BANKO, FILIPPO COLETTI, Stanford University, DANIELE SCHIAVAZZI, University of California, San Diego, CHRISTOPHER ELKINS, JOHN EATON, Stanford University — Understanding the complex flow topology within the human lung is critical to assess gas exchange and particle transport as they relate to the development and treatment of respiratory diseases. While idealized airway models have been investigated extensively, only limited information is available for anatomically accurate geometries. We have measured the full three-dimensional, mean velocity field from the mouth to the sixth bronchial generation in a patient-specific geometry at steady inspiration. Magnetic resonance velocimetry is used to measure the flow of water at realistic Reynolds number in a 3D-printed model derived from the CT scan of a healthy subject. The canonical laryngeal jet is observed; however, its structure is altered by an upstream jet behind the tongue, which is not discussed in the literature. Regions of separation in the supraglottic space are found to generate streamwise vortices. The resulting swirl persists to the first bifurcation and modifies the vorticity distribution in the main bronchi relative to that of a symmetric bifurcation with uniform inlet conditions. An integral momentum distortion parameter is calculated along several complete bronchial paths to assess the impact of branching angle and generation length on the flow field.

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