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3D CFD Simulation of Plug Dynamics and Splitting through a Bifurcating Airway Model CORY HOI, MEHDI RAESSI, Univ of Mass - Dartmouth — Respiratory distress syndrome (RDS) occurs because of pulmonary surfactant insufficiency in the lungs of preterm infants. The common medical procedure to treat RDS, called surfactant respiratory therapy (SRT), involves instilling liquid surfactant plugs into the pulmonary airways. SRT's effectiveness highly depends on the ability to deliver surfactant through the complex branching airway network. Experimental and computational efforts have been made to understand complex fluid dynamics of liquid plug motion through the lung airways in order to increase SRT's response rate. However, previous computational work used 2D airway model geometries and studied plug dynamics of a pre-split plug. In this work, we present CFD simulations of surfactant plug motion through a 3D bifurcating airway model. In our 3D y-tube geometry representing the lung airways, we are not limited by 2D or pre-split plug assumptions. The airway walls are covered with a pre-existing liquid film. Using a passive scalar marking the surfactant plug, the plug splitting and surfactant film deposition is studied under various airway orientations. Exploring the splitting process and liquid distribution in a 3D geometry will advance our understanding of surfactant delivery and will increase the effectiveness of SRT.

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