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Investigation of mucus transport in an idealized lung airway model using multiphase CFD analysis RAHUL RAJENDRAN, ARINDAM BANERJEE, Lehigh University — Mucus, a Bingham fluid is transported in the pulmonary airways by consistent beating of the cilia and exhibits a wide range of physical properties in response to the core air flow and various pathological conditions. A better understanding of the interfacial instability is required as it plays a crucial role in gas transport, mixing, mucus clearance and drug delivery. In the current study, mucus is modelled as a Newtonian fluid and the two phase gas-liquid flow in the airways is investigated using an inhomogeneous Eulerian-Eulerian approach. The complex interface between the phases is tracked using the conventional VOF (Volume of Fluid) method. Results from our CFD simulations which are performed in idealized single and double bifurcation geometries will be presented and the influence of airflow rate, mucus layer thickness, mucus viscosity, airway geometry (branching & diameter) and surface tension on mucus flow behavior will be discussed. Mean mucus layer thickness, pressure drop due to momentum transfer & increased airway resistance, mucus transport speed and the flow morphology will be compared to existing experimental and theoretical data.

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