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In Vitro Microfluidic Models of Mucus-Like Obstructions in Small Airways MOLLY K. MULLIGAN, Technion - Israel Institute of Technology, JAMES B. GROTBERG, University of Michigan, JOSUÉ SZNITMAN, Technion - Israel Institute of Technology — Liquid plugs can form in the lungs as a result of a host of different diseases, including cystic fibrosis and chronic obstructive pulmonary disease. The existence of such fluid obstructions have been found as far down in the bronchiole tree as the sixteenth generation, where bronchiole openings have diameters on the order of a hundred to a few hundred microns. Understanding the propagation of liquid plugs within the bifurcating branches of bronchiole airways is important because their presence in the lungs, and their rupture and break-up, can cause injury to the epithelial cells lining the airway walls as a result of high wall shear stresses. In particular, liquid plug rupture and break-up frequently occurs at airway bifurcations. Until present, however, experimental studies of liquid plugs have generally been restricted to Newtonian fluids that do not reflect the actual pseudoplastic properties of lung mucus. The present work attempts to uncover the propagation, rupture and break-up of mucus-like liquid plugs in the lower generations of the airway tree using microfluidic models. Our approach allows the dynamics of mucus-like plug break-up to be studied in real-time, in a one-to-one in vitro model, as a function of mucus rheology and bronchial tree geometry.

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