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**Elasto-capillary network dynamics of inhalation** FELIX KRATZ, JEAN-FRANCOIS LOUF, Department of Chemical and Biological Engineering, Princeton University, ANVITHA SUDHAKAR, None, NATHANAEL JI, SUJIT DATTA, Department of Chemical and Biological Engineering, Princeton University — The seemingly simple process of inhalation relies on the complex interplay between muscular contraction in the thorax, elasto-capillary interactions in the individual airway branches, connectivity between different branches, and overall air flow into the lungs. Sophisticated pulmonary fluid dynamics models have been developed to elaborate the competition between capillarity, which tends to keep flexible branches closed, and elasticity, which favors opening, for single airway branches. However, a quantitative model combining the physiological opening process of flexible airway branches with the biomechanics and interconnected geometry of the lungs is still missing. To address this issue, we develop a statistical model of the lungs as a symmetrically-branched network of liquid-lined flexible cylinders coupled to a viscoelastic thoracic cavity. Each branch opens at a rate and a pressure that is determined by input biomechanical parameters, enabling us to test the influence of changes in the mechanical properties of lung tissues and secretions on inhalation dynamics. By summing the dynamics of all the individual branches, we quantify the evolution of overall lung pressure and volume during inhalation, and find good agreement with typical breathing curves obtained in the literature.

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