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Acinus-on-a-chip: a microfluidic platform for pulmonary acinar flows RAMI FISHLER, MOLLY MULLIGAN, JOSUE SZNITMAN, Technion- Israel Institute of technology, SZNITMAN BIOFLUIDS TEAM — Convective respiratory flows in the pulmonary acinus and their influence on the fate of inhaled particles are typically studied using computational fluid dynamics (CFD) or scaled-up experimental models. However, current experiments generally capture only flow dynamics, without inhaled particle dynamics, due to difficulties in simultaneously matching flow and particle dynamics. In an effort to overcome these limitations, we have designed a novel microfluidic device mimicking acinar flow conditions directly at the physiological scale. The model features an anatomically-inspired acinar geometry with five dichotomously branching airway generations lined with periodically expanding and contracting alveoli. Using micro-particle image velocimetry (PIV), we reveal experimentally a gradual transition of alveolar flow patterns along the acinar tree from recirculating to radial streamlines, in support of previous predictions from CFD simulations. We demonstrate the applicability of the device for studying the mechanisms of particle deposition in the pulmonary acinus by mapping deposition sites of airborne fluorescent micro-particles (0.1-1μm) and visualizing trajectories of airborne incense particles inside the system.

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