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Mapping low Reynolds number cavity flow phenomena inside microfluidic devices RAMY FISHLER, JOSUE SZNITMAN, Technion- Israel institute of technology — Small-scale cavity flows are known for their usefulness in microfluidic applications. These include devices such as passive micro-mixers and cell diagnostic applications. Concurrently, small-scale cavity flows are physiologically relevant in capturing respiratory flow structures pertinent to the alveolar region of the lung. However, studies in this latter field are typically restricted to computational fluid dynamic (CFD) simulations and scaled-up experimental models based on hydrodynamic similarity matching. In the present study, we investigate low Reynolds number cavity flow phenomena using a microfluidic screening platform featuring rectangular channels with cylindrical cavities. Based on experiments and CFD simulations, we map the detailed cavity flow patterns characterizing a wide range of dimensionless geometric parameters and Reynolds numbers. We find that attached flow is observed at low aspect ratios and large opening angles, while separated flow, characteristic of alveolar flows, is associated with high aspect ratios and small opening angles. These findings provide design guidelines for microfluidic cavity applications and serve as a steppingstone towards designing in vitro microfluidic models of alveolated airways.

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