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Blood Perfusion in Microfluidic Models of Pulmonary Capillary Networks: Role of Geometry and Hematocrit HAGIT STAUBER, Technion-IIT, DAN WAISMAN, Department of Neonatology Carmel Medical Center Faculty of Medicine Technion IIT, JOSUE SZNITMAN, Technion-IIT, TECHNION-IIT TEAM, DEPARTMENT OF NEONATOLOGY CARMEL MEDICAL CENTER AND FACULTY OF MEDICINE - TECHNION IIT COLLABORATION — Microfluidic platforms are increasingly used to study blood microflows at true physiological scale due to their ability to overcome manufacturing obstacle of complex anatomical morphologies, such as the organ-specific architectures of the microcirculation. In the present work, we utilize microfluidic platforms to devise in vitro models of the underlying pulmonary capillary networks (PCN), where capillary lengths and diameters are similar to the size of RBCs ($\sim$ 5-10 μm). To better understand flow characteristics and dispersion of red blood cells (RBCs) in PCNs, we have designed microfluidic models of alveolar capillary beds inspired by the seminal "sheet flow" model of Fung and Sobin (1969). Our microfluidic PCNs feature confined arrays of staggered pillars with diameters of $\sim$ 5,7 and 10 μm, mimicking the dense structure of pulmonary capillary meshes. The devices are perfused with suspensions of RBCs at varying hematocrit levels under different flow rates. Whole-field velocity patterns using micro-PIV and single-cell tracking using PTV are obtained with fluorescently-labelled RBCs and discussed. Our experiments deliver a real-scale quantitative description of RBC perfusion characteristics across the pulmonary capillary microcirculation.

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