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Separation of red blood cells in deep deterministic lateral displacement devices GOKBERK KABACAOGLU, GEORGE BIROS, University of Texas at Austin — Microfluidic cell separation techniques are of great interest since they help rapid medical diagnoses and tests. Deterministic lateral displacement (DLD) is one of them. A DLD device consists of arrays of pillars. Main flow and alignment of the pillars define two different directions. Size-based separation of rigid spherical particles is possible as they follow one of these directions depending on their sizes. However, the separation of non-spherical deformable particles such as red blood cells (RBCs) is more complicated than that due to their intricate dynamics. We study the separation of RBCs in DLD using an in-house integral equation solver. We systematically investigate the effects of the interior fluid viscosity and the membrane elasticity of an RBC on its behavior. These mechanical properties of a cell determine its deformability, which can be altered by several diseases. We particularly consider deep devices in which an RBC can show rich dynamics such as tank-treading and tumbling. It turns out that strong hydrodynamic lift force moves the tank-treading cells along the pillars and downward force leads the tumbling ones to move with the flow. Thereby, deformability-based separation of RBCs is possible.

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