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Tentative topic of the invited talk

Diffusive Flux Modelling of Hematocrit Transport in a Microfluidic Device

Abstract of the invited talk

Platelet-enriched plasma and red blood corpuscles (RBCs) are needed in the treatment of blood-related diseases. These essential components must be separated from blood in well-designed experimental setups. Passive techniques for component separation are preferred over the active, and their design for effectiveness before manufacturing is the subject of this research.

The most significant constituent of blood is the red blood cell, around 8 microns in size, occupying up to 40% of the total volume. It is disk-shaped and deformable as it is transported with the flow. In arteries of 10 mm diameter or higher, an effective viscosity approach or one that is connected to the local shear applies to account for the particulate nature of the suspension. In smaller diameter vessels, unexpected phenomena, for example, the Fahraeus effect, are revealed and call for an independent approach to modeling. The diffusive flux model is one such route that enables the treatment of particulates in blood within a computational fluid dynamics framework. The distribution of the RBC volume fraction, namely, hematocrit, is obtained by solving the particle transport equation arising from the diffusive flux model. The momentum and hematocrit transport equations are coupled through a hematocrit-dependent viscosity. The coupled equations are numerically solved by the finite volume method on a 3D unstructured mesh. The proposed model predicts shear-induced migration of RBCs from the wall to the center of the blood vessel, leading to a cell-free layer (CFL) near the wall. The model is then used to evaluate the performance of a platelet separation device in the form of a trifurcated channel over a range of geometric parameters and hematocrit levels.

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