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Proposal of an automatic method to measure the cell free layer in microchannels with bifurcations

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ABSTRACT

Blood is an opaque, heterogeneous, non-Newtonian fluid composed by a yellowish homogeneous fluid – the plasma – and a series of cellular elements. Red blood cells (RBCs) in microvessels and microchannels has tendency to undergo axial migration due to the parabolic velocity profile which results in a high shear stress around wall that forces the RBCs to move towards the center induced by the tank treading motion of the RBC membrane [1]. As a result there is a formation of a cell free layer (CFL) with extremely low concentration of cells around the walls of the microchannel [1-3]. This phenomenon is commonly observed in both *in vitro* [2, 3] and *in vivo* [4] experiments and has been extensively studied in small straight glass tubes [2, 5]. However, to the best of our knowledge, there are very few quantitative studies on the effect of complex geometries (such as bifurcations and confluences) on the CFL flow behaviour. The main objective of this study is to develop a MatLab script able to measure automatically the RBCs trajectories, at the CFL interface, and CFL thickness in microchannels containing series of bifurcations.

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