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Quantitative experiments and mutli-scale simulations to study Red Blood Cells transmigration through inter-endothelial slits in the spleen[1] ANTONI GARCIA-HERREROS, University of California, San Diego, HUI-JIE LU, ZHANGLI PENG, Univeristy of Illinois at Chicago, JUAN CARLOS DEL ALAMO, University of California, San Diego — During their circulation through the spleen, red blood cells (RBCs) are forced to squeeze through gaps between endothelial cells that are ˜8 times narrower than its diameter. The ensuing squeezing motion causes large RBC deformations that remove old and diseased cells from the circulation. To study the mechanics of RBC splenic filtration, we designed and characterized a family of microfluidic devices where a suspension of human RBCs flows through an array (N = 50) of channels of controlled length (L), width (W) and height (H). We varied these geometrical parameters (0.75<W<3, 4.5<H<10 and 1<L<5 um) and imaged the time-evolving RBC shape as single cells were passing through each channel. We also investigated this process computationally by coupling a multiscale model of the RBC membrane with a boundary integral formulation of the fluids. We find that RBC deformation and motion are strongly correlated with channel geometry upon arrival to the slit. In wider channels RBCs reorient into the direction of less constrain, cell diameter is parallel to the height of the channel. Whereas in narrower channels, cells fold into themselves (U shape) experimenting large deformations.

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