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Dynamics of Red Blood Cells through submicronic splenic slits[1]
EMMANUELE HELFER, PRIYA GAMBHIRE, SCOTT ATWELL, FREDERIC BEDU, IGOR OZEROV, ANNIE VIALLAT, ANNE CHARRIER, Aix Marseille Univ, CNRS, CINaM, Marseille, France, CATHERINE BADENS, Aix Marseille Univ, APHM, La Timone, Department of genetics, Marseille, France, CENTRE DE REFERENCE THALASSEMIE, BADENS TEAM, PHYSICS AND ENGINEERING OF LIVING SYSTEMS TEAM — Red Blood Cells (RBCs) are periodically monitored for changes in their deformability by the spleen, and are entrapped and destroyed if unable to pass through the splenic interendothelial slits (IESs). In particular, in sickle cell disease (SCD), where hemoglobin form fibers inside the RBCs, and in hereditary spherocytosis (HS), where RBCs are more spherical and membrane-cytoskekeleton bonds are weakened, the loss of RBC deformability leads to spleen dysfunction. By combining photolithography and anisotropic wet etching techniques, we developed a new on-chip PDMS device with channels replicating the submicronic physiological dimensions of IESs to study the mechanisms of deformation of the RBCs during their passage through these biomimetic slits. For the first time, with HS RBCs, we show the disruption of the links between the RBC membrane and the underlying spectrin network. In the case of SCD RBCs we show the appearance of a tip at the front of the RBC with a longer time relaxation due to the increased cytoplasmic viscosity.

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