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Dynamics of monocytes flowing in a model pulmonary capillary bed[1] ANNIE VIALLAT, JULES DUPIRE, Adhesion & Inflammation lab / CNRS / Inserm / Aix Marseille University, ADHESION & INFLAMMATION LAB TEAM — The dynamics of blood cells in the pulmonary bed is an issue for tissue perfusion and host defense. The capillary segments in the lungs are smaller than the size of leukocytes so that most of them change their shape to enter and travel through a capillary pathway. During inflammation, changes in the cytoskeleton of leukocytes may stiffen them, resulting in their massive stop and sequestration within lung capillaries. However, due to difficulties of in vivo studies, little is known about the dynamics of leukocytes in the microcirculation and about the coupling between cellular rheology, capillary geometry and flow. We report the dynamics of monocytes (THP-1 cell line) flowing under constant pressure drop in a periodic network of capillaries that mimics the capillary bed. The analysis of cell entrance in the first segment allows the estimation of effective cellular elasticity, viscosity and cortical tension. Cells then present an unsteady regime, with a non-periodic trajectory, a stretching of their average shape and an increase of their velocity. This regime is interpreted from a parameter equivalent to the Deborah number of the system. Finally, a periodic regime is reached with alternatively left and right turns at capillary bifurcations. The reduced cell velocity is governed by an effective friction coefficient between the cell and the capillary walls. Both transient and final regimes depend on cell deformability, as shown by modifying the cortical actin of the cytoskeleton.

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Annie Viallat
Adhesion & Inflammation lab / CNRS / Inserm / Aix Marseille University

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