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Microfluidic approach of Sickled Cell Anemia MANOUK ABKARIAN, ETIENNE LOISEAU, GLADYS MASSIERA, Laboratoire Charles Coulomb, Université Montpellier 2-CNRS — Sickle Cell Anemia is a disorder of the microcirculation caused by a genetic point mutation that produces an altered hemoglobin protein called HbS. HbS self-assembles reversibly into long rope like fibers inside the red blood cells. The resulting distorded sickled red blood cells are believed to block the smallest capillaries of the tissues producing anemia. Despite the large amount of work that provided a thorough understanding of HbS polymerization in bulk as well as in intact red blood cells at rest, no consequent cellular scale approaches of the study of polymerization and its link to the capillary obstruction have been proposed in microflow, although the problem of obstruction is in essence a circulatory problem. Here, we use microfluidic channels, designed to mimic physiological conditions (flow velocity, oxygen concentration, hematocrit...) of the microcirculation to carry out a biomimetic study at the cellular scale of sickled cell vaso-occlusion. We show that flow geometry, oxygen concentration, white blood cells and free hemoglobin S are essential in the formation of original cell aggregates which could play a role in the vaso-occlusion events.

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