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Numerical simulation of platelet margination in microcirculation
HONG ZHAO, ERIC SHAQFEH, Stanford University — The adhesion of platelets to vascular walls is the first step in clotting. This process critically depends on the preferential concentration of platelets near walls. The presence of red blood cells, which are the predominant blood constituents, is known to affect the steady state platelet concentration and the dynamic platelet margination, but the underlying mechanism is not well understood to-day. We use a direct numerical simulation to study the platelet margination process, with particular emphasis on the Stokesian hydrodynamic interactions among red cells, platelets, and vessel walls. Well-known mechanical models are used for the shearing and bending stiffness of red cell membranes, and the stiffer platelets are modeled as rigid discoids. A boundary integral formulation is used to solve the flow field, where the numerical solution procedure is accelerated by a parallel $O(N \log N)$ smooth particle-mesh Ewald method. The effects of red cell hematocrit and deformability will be discussed.

Hong Zhao
Stanford University

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