Abstract Submitted
for the DFD09 Meeting of
The American Physical Society

Numerical Study on Flows of Red Blood Cells with Liposome-Encapsulated Hemoglobin at Microvascular Bifurcation TORU HYAKUTAKE, Yokohama National University, SHIGEKI TANI, YUKI AKAGI, Okayama University, TAKESHI MATSUMOTO, Osaka University, SHINICHIRO YANASE, Okayama University — Flow analysis at microvascular bifurcation after partial replacement of red blood cell (RBC) with liposome-encapsulated hemoglobin (LEH) was performed using the lattice Boltzmann method. A two-dimensional bifurcation model with a parent vessel and daughter branch was considered, and the distributions of the RBC, LEH, and oxygen fluxes were calculated. The immersed boundary method was employed to incorporate the fluid–membrane interaction between the flow field and deformable RBC When only RBCs flow into the daughter branches with unevenly distributed flows, plasma separation occurred and the RBC flow to the lower-flow branch was disproportionately decreased. On the other hand, when the half of RBC are replaced by LEH, the biasing of RBC flow was enhanced whereas LEH flowed favorably into the lower-flow branch, because many LEH within the parent vessel are suspended in the plasma layer, where no RBCs exist. Consequently, the branched oxygen fluxes became nearly proportional to flows. These results indicate that LEH facilitates oxygen supply to branches that are inaccessible to RBCs.

Toru Hyakutake
Yokohama National University

Date submitted: 07 Aug 2009 Electronic form version 1.4