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Numerical study on the dynamics and oxygen transport of a healthy red blood cell and a malaria-infected red blood cell PAHALA GEDARA JAYATHILAKE, Singapore-MIT Alliance, National University of Singapore, LIU GANG, KHOO BOO CHEONG, Department of Mechanical Engineering, National University of Singapore — In the present work, a red blood cell (RBC) and a malaria-infected red blood cell (IRBC) moving along a capillary are simulated with including their permeable properties of the membranes by using a numerical technique based on the two-dimensional immersed interface method. The adhesiveness of the IRBC membrane is modeled by means of a potential function. Then, the model is employed to simulate the motion of a biconcave RBC in the absence of membrane stickiness and a more rigid and circular IRBC in the presence of membrane stickiness. The results show that the RBC gradually moves away from the capillary wall while the IRBC rolls on the capillary wall due to its stickiness. This rolling behavior of the IRBC agrees well with experimental findings. It is found that the resistance on the plasma flow given by the IRBC is larger than the corresponding resistance given by the RBC revealing that macrovascular blockage could happen due to malaria infection. Furthermore, oxygen transport in capillaries and oxygen absorption by nearby muscles are investigated in the presence of a RBC and an IRBC.

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