Blood stage of malaria infection: Lessons from multi-scale modeling

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Malaria is caused by the parasite Plasmodium *falciparum*. During the blood stage of infection, the parasite invades red blood cells (RBC) and multiplies inside the host cell. Parasite multiplication is also followed by tremendous structural and physical changes in the host cell. For instance, infected RBCs become stiffer, develop a rounded shape and develop adhesive protrusions (knobs). Knobs enable the infected RBC to bind to endothelial cells, which is a crucial step in the parasite's survival process. Therefore, it is very essential to understand the adhesion dynamics of infected RBC in blood flow. In this talk, I will discuss the adhesion dynamics of infected RBC on a substrate using multiscale modelling of infected RBC and fluid flow. I will show how cell deformability, cell adhesion, and fluid shear stress induce distinct dynamical adhesion states in shear flow. The results from mesoscopic simulations will be compared with microfluidic flow camber experiments on endothelial cells and on functionalized membranes. I will also show how we can exploit mesoscopic simulations to predict the physiological outcomes that can be used for clinical diagnosis.