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TITLE

Characterization of the effects of blood cells on Nanoparticle delivery in microcirculation

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A 3D multiscale particle-cell hybrid model and a microfluidic platform are developed to model nanoparticle transport, dispersion, and adhesion dynamics in blood suspension. The motion and deformation of red blood cell is captured through Immersed Finite Element method. The influences of vascular flow rate, geometry, nanoparticle shape and size on nanoparticle distribution and delivery efficacy are characterized. . A non-uniform nanoparticle distribution profile with higher particle concentration near the vessel wall is observed. Such distribution leads to 50% higher particle binding rate compared to the case without RBC considered. The tumbling motion of RBCs in the core region of the capillary is found to enhance nanoparticle dispersion. The modeled binding results are validated through designed experiments in microfluidic devices. Results from this study contribute to the fundamental understanding and knowledge on how the particulate nature of blood and nanoparticle influences for nanoparticle delivery efficiency, which will provide mechanistic insights on the nanomedicine design for targeted drug delivery.

Biography

Liu received my PhD degree from Northwestern University in 2006. His primary research interest is on particulate and interfacial phenomena at the micro/nano scale and in biological systems. Liu have produced 23 peer-reviewed manuscripts, 6 book chapters, and numerous conference proceedings. He also serves as a reviewer for various peer-reviewed journals and a grant reviewer for NSF and NIH.