Abstract Submitted
for the DFD17 Meeting of
The American Physical Society

Capture of microparticles by bolus flow in capillaries.[1] NAOKI TAKEISHI, Osaka University, YOHSUKE IMAI, Tohoku University, BFSL COLLABORATION — Previous studies have concluded that microparticles (MPs) can more effectively approach the microvessel wall than nanoparticles because of margination. In this study, however, we show that MPs are not marginated in capillaries where the vessel diameter is comparable to that of red blood cells (RBCs). We numerically investigated the behavior of MPs with a diameter of 1 m in various microvessel sizes, including capillaries. In capillaries, the flow mode of RBCs shifted from multi-file flow to bolus flow, and MPs were captured by the bolus flow of the RBCs instead of being marginated. Once MPs were captured, they rarely escaped from the vortex-like flow structures between RBCs. These capture events were enhanced when the hematocrit was decreased, and reduced when the shear rate was increased. Our results suggest that microparticles may be rather inefficient drug carriers when targeting capillaries because of capture events, but nanoparticles, which are more randomly distributed in capillaries, may be more effective carriers.

[1]This research was supported by JSPS KAKENHI Grant Numbers 25000008 and 16J11479.

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Date submitted: 12 Jun 2017 Electronic form version 1.4