Abstract Submitted
for the DFD16 Meeting of
The American Physical Society

Seamless particle-based modeling of blood clotting[1] ALIREZA YAZDANI, GEORGE KARNIADAKIS, Brown University — We propose a new multiscale framework that seamlessly integrate four key components of blood clotting namely, blood rheology, cell mechanics, coagulation kinetics and transport of species and platelet adhesive dynamics. We use transport dissipative particle dynamics (tDPD) which is an extended form of original DPD as the base solver to model both blood flow and the reactive transport of chemical species in the coagulation cascade. Further, we use a coarse-grained representation of blood cell's membrane that accounts for its mechanics; both red blood cells and platelets are resolved at sub-cellular resolution, and stochastic bond formation/dissociation are included to account for platelet adhesive dynamics at the site of injury. Our results show good qualitative agreement with in vivo experiments. The numerical framework allows us to perform systematic analysis on different mechanisms of blood clotting. In addition, this new multiscale particle-based methodology can open new directions in addressing different biological processes from sub-cellular to macroscopic scales.

[1]NIH Grant No. U01HL116323

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Date submitted: 01 Aug 2016 Electronic form version 1.4