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Mesoscopic Modeling of Blood Clotting: Coagulation Cascade and Platelets Adhesion ALIREZA YAZDANI, ZHEN LI, GEORGE KARNIADAKIS, Brown University — The process of clot formation and growth at a site on a blood vessel wall involve a number of multi-scale simultaneous processes including: multiple chemical reactions in the coagulation cascade, species transport and flow. To model these processes we have incorporated advection-diffusion-reaction (ADR) of multiple species into an extended version of Dissipative Particle Dynamics (DPD) method which is considered as a coarse-grained Molecular Dynamics method. At the continuum level this is equivalent to the Navier-Stokes equation plus one advection-diffusion equation for each specie. The chemistry of clot formation is now understood to be determined by mechanisms involving reactions among many species in dilute solution, where reaction rate constants and species diffusion coefficients in plasma are known. The role of blood particulates, i.e. red cells and platelets, in the clotting process is studied by including them separately and together in the simulations. An agonist-induced platelet activation mechanism is presented, while platelets adhesive dynamics based on a stochastic bond formation/dissociation process is included in the model.

Alireza Yazdani
Brown University

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