Abstract Submitted
for the DFD16 Meeting of
The American Physical Society

Computational reconstruction and fluid dynamics of in vivo thrombi from the microcirculation MEHRAN MIRRAMEZANI, Mechanical Engineering, University of California, Berkeley, MAURIZIO TOMAIUOLO, TIMOTHY STALKER, Department of Medicine, University of Pennsylvania, SHAWN SHADDEN, Mechanical Engineering, University of California, Berkeley — Blood flow and mass transfer can have significant effects on clot growth, composition and stability during the hemostatic response. We integrate in vivo data with CFD to better understand transport processes during clot formation. By utilizing electron microscopy, we reconstructed the 3D thrombus structure formed after a penetrating laser injury in a mouse cremaster muscle. Random jammed packing is used to reconstruct the microenvironment of the platelet aggregate, with platelets modeled as ellipsoids. In our 3D model, Stokes flow is simulated to obtain the velocity field in the explicitly meshed gaps between platelets and the lumen surrounding the thrombus. Based on in vivo data, a clot is composed of a core of highly activated platelets covered by a shell of loosely adherent platelets. We studied the effects of clot size (thrombus growth), gap distribution (consolidation), and vessel blood flow rate on mean intrathrombus velocity. The results show that velocity is smaller in the core as compared to the shell, potentially enabling higher concentration of agonists in the core contributing to its activation. In addition, our results do not appear to be sensitive to the geometry of the platelets, but rather gap size plays more important role on intrathrombus velocity and transport.

Mehran Mirramezani
Mechanical Engineering, University of California, Berkeley

Date submitted: 01 Aug 2016 Electronic form version 1.4