Abstract Submitted
for the DFD11 Meeting of
The American Physical Society

Blood Flow through an Open-Celled Foam JASON ORTEGA, LLNL, DUNCAN MAITLAND, Texas A&M University, LLNL — The Hazen-Dupuit-Darcy (HDD) equation is commonly used in engineering applications to model the pressure gradient of flow through a porous media. One major advantage of this equation is that it simplifies the complex geometric details of the porous media into two coefficients: the permeability, K, and form factor, C. However through this simplification, the flow details within the porous media are no longer accessible, making it difficult to study the phenomena that contribute to changes in K and C due to clotting of blood flow. To obtain a more detailed understanding of blood flow through a porous media, a direct assessment of the complex interstitial geometry and flow is required. In this study, we solve the Navier-Stokes equations for Newtonian and non-Newtonian blood flow through an open-celled foam geometry obtained from a micro-CT scan. The nominal strut size of the foam sample is of O(10e-5) m and the corresponding Reynolds number based upon this length ranges up to O(10). Fitting the pressure gradient vs. Darcy velocity data with the HDD equation demonstrates that both viscous and inertial forces play an important role in the flow through the foam at these Reynolds numbers. Recirculation zones are observed to form in the wake of the pore struts, producing regions of flow characterized by both low shear rates and long fluid residence times, factors of which have been shown in previous studies to promote blood clotting.

Jason Ortega
LLNL

Date submitted: 30 Jul 2011 Electronic form version 1.4