Abstract Submitted
for the DFD15 Meeting of
The American Physical Society

Secondary flow structure in a model curved artery: 3D morphology and circulation budget analysis[1] KARTIK V BULUSU, MICHAEL W PLESNIAK, George Washington University — In this study, we examined the rate of change of circulation within control regions encompassing the large-scale vortical structures associated with secondary flows, i.e. deformed Dean-, Lyne- and Wall-type (D-L-W) vortices at planar cross-sections in a 180° curved artery model (curvature ratio, 1/7). Magnetic resonance velocimetry (MRV) and particle image velocimetry (PIV) experiments were performed independently, under the same physiological inflow conditions (Womersley number, 4.2) and using Newtonian blood-analog fluids. The MRV-technique performed at Stanford University produced phase-averaged, three-dimensional velocity fields. Secondary flow field comparisons of MRV-data to PIV-data at various cross-sectional planes and inflow phases were made. A wavelet-decomposition-based approach was implemented to characterize various secondary flow morphologies. We hypothesize that the persistence and decay of arterial secondary flow vortices is intrinsically related to the influence of the out-of-plane flow, tilting, in-plane convection and diffusion-related factors within the control regions. Evaluation of these factors will elucidate secondary flow structures in arterial hemodynamics.

[1]Supported by the National Science Foundation under Grant Number CBET-0828903, and GW Center for Biomimetics and Bioinspired Engineering (COBRE). The MRV data were acquired at Stanford University in collaboration with Christopher Elkins and John Eaton.

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Date submitted: 01 Aug 2015 Electronic form version 1.4