Abstract Submitted
for the DFD08 Meeting of
The American Physical Society

Cardiovascular microbubble transport in vessel bifurcations with pulsatile flow: experimental model and theory[1] DOUG VALASSIS, ROBERT DODDE, BRIJESH ESHPUNIYANI, J. BRIAN FOWLKES, JOSEPH BULL, University of Michigan — The behavior of long gas bubbles suspended in liquid flowing through successive bifurcations was investigated experimentally and theoretically as a model of cardiovascular bubble transport in gas embolotherapy. In this developmental cancer therapy, perflurocarbon droplets are vaporized in the vasculature and travel through a bifurcating network of vessels before lodging. The homogeneity of tumor necrosis is directly correlated with the transport and lodging of the emboli. An experimental model was used to explore the effects of flow pulsatility, frequency, gravity, and bifurcation roll angle on bubble splitting and lodging. At a bifurcation roll angle of 45-degrees, the most distinct difference in splitting ratios between three physiologic frequencies (1, 1.5, 2 Hz) was observed. As roll angle increased, lodged bubble volume in the first generation channel increased while bubble volume beyond the second bifurcation proportionately decreased. A corresponding time-dependent one-dimensional theoretical model was also developed. The results elucidate the effects of pulsatile flow and suggest the potential of gas embolotherapy to occlude blood flow to tumors.

[1]This work was supported by NIH grant R01EB006476.

Joseph Bull
University of Michigan

Date submitted: 04 Aug 2008