Abstract Submitted
for the DFD05 Meeting of
The American Physical Society

Floppy capsules in a viscous channel flow with application to leukocyte transport JONATHAN FREUND, UIUC — A boundary integral method is used to simulate the Stokes flow of 100 two-dimensional capsules in a rectangular streamwise periodic channel. The capsule walls are two-dimensional shells with reference length, linear tensile elasticity modulus, and linear bending modulus selected so that the an isolated capsule has a bi-concave minimum energy shape analogous to a human red blood cell. The reference shape of the capsules is circular with diameter d and the channel is $13.5d$ wide and its period in the streamwise direction is also $13.5d$. Viscosity of the fluids inside and outside the capsules is matched. For fixed tensile-bending moduli ratio, it is found that the distribution of cell centroids in the channel is insensitive to the floppiness of the capsules. A larger stiff circular capsule is added to model a leukocyte (white cell). It is found that hydrodynamic forces alone keep the leukocyte in near contact with the channel wall for tens to hundreds of channel flow-through periods, with floppier red-cell-like capsules significantly promoting extended contact. A leukocyte in the free stream tends to stay near the center of the channel and has not been yet been observed to return to the wall even after nearly 1000 flow through periods.

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Date submitted: 12 Aug 2005 Electronic form version 1.4