Abstract Submitted
for the DFD08 Meeting of
The American Physical Society

Dynamics of Lipid Bilayer Vesicles in Viscous Flows JONATHAN SCHWALBE, Northwestern University, PETIA VLAHOVSKA, Dartmouth College, MICHAEL J. MIKSIS, Northwestern University — An analytical theory is developed to describe the dynamics of a closed lipid bilayer membrane (vesicle) in a general linear viscous flow. The dynamics of the membrane is governed by the Stokes equations in the fluid plus the normal and tangential stress condition along the bilayer interface. The effects of the membrane fluidity, incompressibility and resistance to bending are taken into account. The model is a generalization of the work on planar membranes by Seifert and Langer (Europhys. Lett. vol. 23, 71, 1993), which accounted for the variations in lipid density along both leaflets of the bilayer. Considering a nearly spherical vesicle, a perturbation solution is derived. The leading order analysis results in a nonlinear coupled system of equations for the dynamics of the shape and the mean lipid density difference between the inner and outer monolayer. Multiple solution states are found as a function of viscosity ratio and the monolayer slip coefficient. The dynamics and stability of these solutions is discussed. Comparisons are made to previous works based on the minimal curvature model which did not consider variable lipid density.

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Date submitted: 01 Aug 2008

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