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**Vesicle dynamics in linear viscous flows** PETIA VLAHOVSKA, Thayer School of Engineering, Dartmouth College, RUBEN SERRAL-GRACIA, Max-Planck Institute of Colloids and Interfaces, Theory Department — A vesicle is a capsule made of phospholipid bilayer membrane; it is widely employed as a cell paradigm. A vesicle in shear flow represents a simple model system to study cell dynamics in the microcirculation. We develop an analytical theory for the dynamics of a quasi–spherical vesicle in a linear viscous flow. The analysis includes the effects of the viscosity contrast between the inner and suspending fluids and the membranes bending stresses on the flow–induced vesicle deformation. We obtain that in simple shear flow the leading order stationary vesicle shape and orientation angle with respect to the flow are independent of the membrane bending rigidity. If the viscosity contrast exceeds a critical value, which depends on the vesicle excess area, no stationary solution exist and the vesicle tumbles with frequency which increases with viscosity contrast and approaches the rotation rate of the external flow. Non-Newtonian rheology with both shear thinning viscosity and normal stresses is predicted for a dilute suspension of vesicles. The results agree well with published experimental data for vesicle behavior in shear flows.

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