AEROSPACE & MECHANICAL ENGINEERING

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UNIVERSITY OF NOTRE DAME, NOTRE DAME, INDIANA 46556

SPEAKER: **Prof. Eric S.G. Shaqfeh**
Department of Chemical Engineering
Stanford University
Stanford, California

TOPIC: **THE MICROHYDRODYNAMICS OF VESICLES, VESICLE SUSPENSIONS, AND BLOOD**

DATE: Tuesday, April 23, 2013

TIME: 3:30 p.m.

PLACE: Lower Level Auditorium, Geddes Hall

RECEPTION: 3:00 – 3:30 p.m. – Coffee House, Geddes Hall

ABSTRACT

It is well known that individual vesicles or liposomes (i.e. fluid enclosed by a lipid bilayer membrane suspended in a second fluid) are characterized by a remarkable dynamics in flow. For vesicles that are "near spheres" this dynamics includes at least 5 different types of orbits in shear flow that are functions of the viscosity ratio between the inner and outer fluid as well as the Capillary number based on the bending modulus. However, this dynamics becomes even more rich as the reduced volume falls below about 0.65 where now there are at least three equilibrium shapes (prolates, discocytes, and stomatocytes) which are linearly stable. It is therefore not surprising that a suspension of vesicles is characterized by fascinating collective behavior as well. I will discuss our recent development of a numerical code (based on Loop subdivision) which allows the Stokes flow simulation of non-dilute suspensions of vesicles and capsules at essentially any value of the reduced volume. We will then use these numerical simulations to examine a number of interesting phenomena including: 1) The lift of a vesicle away from a wall and the resulting "Fahraeus-Lindqvist" (FL) layer for the flow of a wall-bound suspension of vesicles, 2) The effective rheology and dynamics of a non-dilute vesicle suspension under shear, and 3) The stability of vesicle shapes in extensional flows. We shall then demonstrate that our knowledge of the FL Layer in vesicle suspensions can lead immediately to an understanding of the same layer in flowing blood in the microcirculation – a subject of critical importance in blood physiology. We shall finish with dynamic simulations of flowing blood and a kinetic theory for predicting the FL layer that is quantitative when compared to *in vitro* experiments.

NOTE: ***If you are interested in meeting individually with Prof. Shaqfeh, please contact Linda at 631-5431***