

Abstract Submitted
for the DFD05 Meeting of
The American Physical Society

Normal force exerted on vascular endothelial cells PANAGIOTIS DIMITRAKOPOULOS, YECHUN WANG, Department of Chemical and Biomolecular Engineering, University of Maryland, College Park, MD 20742-2111 — Hemodynamic forces play a pivotal role in the normal and pathological behavior of vascular endothelial cells. A plethora of studies, mainly in the last two decades, has attributed the behavior, or changes in the behavior, of the endothelium as a result of one of the two components of the hemodynamic force, i.e. as effects of the shear stress. For example, shear stress has found to increase the endothelial hydraulic conductivity, to regulate occludin content and phosphorylation, and to affect the ability of cells to induce adhesion of flowing neutrophils. Based on computational investigation and scaling analysis, our study shows that the normal force contributes significantly to the total force on the endothelium cells even in large vessels. Since both normal and shear forces can affect the stretching and bending of the cell membrane, our study suggests that both the normal and the pathological behavior of endothelial cells is affected by the normal force exerted on them. The effects of the normal force are more pronounced for smaller vessels and/or less spread cells. These conclusions are in direct contrast to the common practice of previous studies which attribute the operation of endothelial cells to the shear stress exerted on them, and thus neglect the normal force contribution.

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Date submitted: 12 Aug 2005

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