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Prediction of Low-density Lipoprotein Concentration on the Lumen Surface of Pathological Blood Vessels Using Wall Shear Stress. SATYAJIT CHOUDHURY, Department of Applied Mechanics, Indian Institute of Technology Madras, KAMESWARARAO ANUPINDI, Department of Mechanical Engineering, Indian Institute of Technology Madras, B.S.V PATNAIK, Department of Applied Mechanics, Indian Institute of Technology Madras — Accumulation of low-density lipoprotein (LDL) on the lumen surface of blood vessels is central to the initiation and progression of many cardiovascular diseases. It has been found that, in high Schmidt number flows, it is the near-wall flow dynamics that dictate the transport and accumulation of the LDL on the lumen surface. Since wall shear stress (WSS) offers a reasonable approximation of near-wall flow dynamics, our study utilizes WSS to predict the variation of concentration of LDL on the lumen surface of symmetric 2D as well as asymmetric 3D pathological arteries. Blood is considered as Newtonian, incompressible and modeled using the Navier-Stokes equation whereas, the transport of LDL is governed by the passive scalar advection-diffusion equation. Even though the flow is pulsatile, it is found that time-averaged WSS gives a very good prediction of the variation of LDL concentration on the lumen surface. It is seen that low WSS need not necessarily lead to high LDL concentration. The influence of the stagnation points (region of zero WSS) on LDL concentration is also explored in the present work.

> Satyajit Choudhury Department of Applied Mechanics, Indian Institute of Technology Madras

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