



THE UNIVERSITY OF
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Mechanical Engineering

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Cardiovascular diseases, principally atherosclerosis, are responsible for 29% of world deaths. The World Health Organisation reported coronary heart disease, stroke and other cerebrovascular diseases as the leading causes of global death. Cardiovascular diseases are associated with abnormal blood flow patterns that can cause heart attacks and stroke. Atherosclerosis is associated with vessel narrowing causing localised constrictions called 'stenoses'. It is recognised that the initiation and development of disease is a complex interplay between the local biomechanical environment, including effects produced by blood flow, and the local vascular biology. The variables inherent in an in-vivo study of the mechanisms of arterial disease are extremely complex, comprising the biology and chemistry of the materials, the geometric variation in arterial formation and, not least, the complexity of the blood itself: a non-Newtonian mixture of red and white cells increasing the normalised bulk viscosity to 400% of the carrier fluid. For this reason, studies tend to be either statistical, in-vivo or simplified numerical/experimental.

In this paper I will look at the behaviour of spherical and non-spherical particles (c. 10-20 microns) in idealised geometries. Experimental investigations in our laboratories using particle image velocimetry and analysis of scattering intensity demonstrate a clustering of particles in the core of the vortex and in an annulus, even at relatively low concentrations. Particle migration away from the artery wall, initially believed only to be significant in very small arteries and arterioles is shown to occur for geometries representing major arteries. This has significance for biochemical transport and biomechanical sensing on the endothelium (lining) of the artery wall.

Most simulations of particle flow invoke point-particle models. Preliminary results from mesh-morphing simulations of particles with displaced volume will be presented.

Bill is currently Professor of Fluid Mechanics at The University of Edinburgh in Scotland. He has recently stepped down from various management positions at Edinburgh. His responsibilities have included Head of Department of Mechanical Engineering and Head of the Institute for Materials and Processes. Over the past 3 years he has worked to form the Centre for Biomedical Engineering at Edinburgh, a joint venture between the School of Medicine and School of Engineering.

Bill's 30 years in Fluid Mechanics have taken him from the large scale studies of wave loading on offshore structures all the way down to flow in the human arterial system. He is a Fellow of the Institution of Mechanical Engineers and currently Secretary of the recently-formed UK Bioengineering Society. He is a member of the European Society of Biomechanics and on the organising committee for its 17th Congress in Edinburgh in July.

Prof William (Bill) Easson

Professor of Fluid Mechanics
The University of Edinburgh
Scotland

Tuesday 25th May, 3pm

Lecture Theatre
Level 3, Mechanical Engineering
Building 170, Block E

Particle Motion in Human Arteries.

MORE INFORMATION

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