Contribution ID: **229** Type: **Oral Presentation**

Modelling the Endothelial Glycocalyx layer in the microcirculation using homogenisation

Thursday, 12 July 2018 15:40 (20 minutes)

The Endothelial Glycocalyx Layer (EGL) is a porous macromolecular layer that lines the insides of blood vessels. It is located on the important interface between the endothelium and flowing blood and as such is believed to play a number of important roles including transducing mechanical signals from flowing blood and regulating vessel permeability. Previous work modelling the EGL at the continuum level has typically assumed that it is a homogenous isotropic porous media and that if deformable; it does so as a linear-elastic block. In this work, we use homogenisation theory to derive a more sophisticated model of the EGL that takes into account what is known about the underlying periodic microstructure of the EGL.

Homogenisation theory is a method of multiple scales that allows us to exploit the periodicity in the problem as well as the much smaller length scale (compared to the macroscopic scale) over which this periodicity exists. This allows us to derive an overall continuum level model of the EGL that takes into account this microstructure while still retaining a lower level model for the flow around the microstructure. In deriving this model, we find that it differs from other fluid flow models typically obtained from homogenisation theory as the EGL is only periodic tangentially to the vessel surface and not normally.

This more sophisticated model allows us to investigate the effects of anisotropy in the model at the continuum level as endowed by the geometry of its microstructure. In addition, the underlying microstructural model allows us to obtain measures such as the solid shear stress experienced by the endothelium and the torque induced by flow over the EGL that cannot be directly obtained from previous continuum level models and is an important measure for functions such as mechanotransduction.

Primary authors: Mr LEE, Tet Chuan (University of Auckland); Dr LONG, David S (Wichita State University); Dr SURESH, Vinod (University of Auckland); Dr CLARKE, Richard J (University of Auckland)

Presenter: Mr LEE, Tet Chuan (University of Auckland)

Session Classification: Fluids & blood

Track Classification: Human Physiology