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Three-dimensional Simulations of Idealised Lymphangion

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Introduction

The lymphatic system is responsible for collecting fluid leaked from blood vessels, returning it to the blood system to maintain overall fluid balance. Lymphatic vessels also fulfill important immune functions by transporting leukocytes and antigens [1,2,3]. The functional units of collecting lymphatic vessels are called the lymphangions [2,4]. Some experimental and computational studies exist, however much still needs learnt about the transport mechanisms.

Methods

An idealised geometry of a lymphangion unit is considered. This consists of a deforming cylinder with valves at either end. The flow is considered to be periodic. The Moving Particle Semi-implicit (MPS) method is employed, since this has been shown to be effective in simulation of micro-circulation [5]. Periodic boundary conditions are employed in order to investigate time integrated measures.

Results & Discussion

A parametric study is carried out, varying geometry of the lymphangion and the pulsatility of the lymph. We study the redistribution of particles as they traverse the valve constriction, looking at the forces imposed on cells and the transport properties.

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