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Multiphase Flow Modellingof Magnetically Targeted Stem Cell Delivery[1] EDWINA YEO, University of Oxford, ALICIA EL HAJ, University of Birmingham, JAMES OLIVER, SARAH WATERS, University of Oxford — Targeting delivery of stem cells to the site of an injury is a key challenge in regenerative medicine. One possible approach is to inject cells implanted with magnetic nanoparticles into the blood stream. Cells can then be targeted to the delivery site by an external magnetic field. At the injury site, it is of critical importance that the cells do not form an aggregate which could significantly occlude the vessel.We develop a multiphase flow model for the transport of magnetically tagged cells in blood under the action of an external magnetic field. We consider a two phase system of blood and stem cells in a single vessel. We exploit the small aspect ratio of the vessel to examine the system asymptotically. We consider the system for a range of magnetic field strengths and varying strengths of the drag coefficient between the phases. We examine the dynamics close the magnet as the captured stem cells form a porous mass. We explore the different regimes of the model and determine the optimal conditions for the effective delivery of stem cells while minimising vessel occlusion.

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