Abstract Submitted
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Mathematical model of a valve-controlled, gravity driven bioreactor for platelet production[1] HELEN ZHA, University of Oxford, DANIEL HOWARD, CEDRIC GHEVAERT, RUTH CAMERON, SERENA BEST, University of Cambridge, JAMES OLIVER, SARAH WATERS, University of Oxford — Hospitals sometimes experience shortages of donor blood platelet supplies, motivating research into *in vitro* production of platelets. We model a novel platelet bioreactor described in Shepherd et al.[1] The bioreactor consists of an upper channel, a lower channel, and a cell-seeded porous collagen scaffold situated between the two. Flow is driven by gravity, and controlled by valves on the four inlets and outlets. The bioreactor is long relative to its width, a feature which we exploit to derive a lubrication reduction of unsteady Stokes flow coupled to Darcy. As the shear stress experienced by cells influences platelet production, we use our model to quantify the effect of varying pressure head and valve dynamics on shear stress. 1: Shepherd, J.H., Howard, D., Waller, A.K., Foster, H.R., Mueller, A., Moreau, T., Evans, A.L., Arumugam, M., Chalon, G.B., Vriend, E. and Davidenko, N., 2018. Structurally graduated collagen scaffolds applied to the ex vivo generation of platelets from human pluripotent stem cell-derived megakaryocytes: enhancing production and purity. *Biomaterials*, *182*, pp.135-144.

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