Abstract Submitted
for the DFD12 Meeting of
The American Physical Society

Flow through a free-moving porous cylinder within a rotating cylindrical vessel[1] MOHIT P. DALWADI, SARAH L. WATERS, University of Oxford — Tissue engineering aims to repair or replace damaged body tissue via the engineering of artificial tissues. One method is to seed cells onto a porous biomaterial construct which is then cultured within a rotating bioreactor. We investigate a rotating high-aspect ratio vessel bioreactor that contains a free-moving porous tissue construct. We extend the work of Cummings and Waters [2007], who considered a solid tissue construct, by coupling a single-phase flow external to the tissue construct (modeled by the Navier-Stokes equations) to two-phase flow through the porous tissue construct (modeled using Darcy's equations) via appropriate boundary conditions. We study two flow regimes, corresponding to *near-to* and *far-from* rigid body rotation. We determine the fluid flow through the system for a given construct trajectory. By considering a force balance to deduce the construct trajectory, we obtain a full description of the flow behaviour and the fluid particle paths. We ascertain the residence time of fluid within the construct and, in the future, this work will enable us to calculate the role of advection in the spatiotemporal nutrient distribution, an important consideration for the tissue growth problem.

[1]Funded by EPSRC

Mohit P. Dalwadi
University of Oxford

Date submitted: 18 Jul 2012 Electronic form version 1.4