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Modelling nutrient delivery to cells grown in a multiscale perfusable system MOHIT DALWADI, University of Oxford — Growing cells *in vitro* expedites the process of testing viable drugs and reduces the need for animal testing. However, current methods to grow 3D structures eventually result in the formation of a necrotic core due to lack of nutrient access. One way to circumvent this is to use 3D bioprinting and photopatterning techniques to engineer multiscale perfusable systems that enhance nutrient delivery to cells. While these techniques offer a high degree of control over the configuration of the perfusable channels, it is not clear how the channels or cells should be distributed in order to maximize nutrient transport and avoid necrotic zones. To tackle these problems, it is imperative to have knowledge of the fluid flow within the perfusable hydrogel system; advection is the dominant nutrient transport mechanism. Thus, understanding and being able to control the flow within the bioreactor is paramount. In this talk, we use mathematical modelling to investigate how the nutrient transport to the growing cells is affected by experimentally controlled parameters, such as channel distribution, cell density, and the flux rate of nutrient fluid through the perfusable hydrogel structure.

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