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On cell proliferation in a tissue engineering scaffold pore, effects of nutrient concentration and scaffold internal geometry[1] ZESHUN ZONG, Courant Institute, New York University, XINYU LI, New York University, Shanghai, PEJMAN SANAEI, New York Institute of Technology — Cell proliferation within a porous tissue engineering scaffold perfused with nutrient solution depends sensitively on the choice of pore geometry, flow rates, and nutrient concentration. Regions of high pore curvature encourage cell proliferation, while a critical flow rate is required to promote growth. Moreover, the dynamics of the nutrient culture medium consumption influence the cell growth. In experiments, such factors should be chosen meticulously to match the characteristics of the underlying cells and the particular goal of incubation. However, determining these factors poses a significant challenge that cannot be addressed by experimentation alone. In this talk, we present a first-principle mathematical theory for the nutrient concentration coupled to the growth of cells seeded on the pore walls, which is driven by the fluid flow within a tissue engineering scaffold pore. In addition, using asymptotic analysis based on the pore small aspect ratio, we derive a reduced model that enables a comprehensive analysis of the system to be performed. This approach reduces the numerical burdens, captures the experimental observations and suggests improvements to the design of a tissue engineering scaffold and the appropriate operating regime.

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