Flow Transport Phenomena in Tissue Engineering: Flow Characterization and Modeling of Cartilage Development in a Spinner-Flask Bioreactor

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The dynamic environment in bioreactors is known to affect tissue development in vitro. Chondrocytes, the building blocks of articular cartilage, for example, are stimulated by mechanical stresses such as shear. On the other hand, high shear can damage cells. Therefore, the optimization of bioreactor design and operating conditions necessitates the control of the shear stress environment. This book focuses on the formulation of relationships between tissue growth and the local shear stress in the context of the tissue engineering of cartilage in spinner-flask bioreactors. The analysis consists of the characterization of the flow in a model bioreactor, the measurement of glycosaminoglycan synthesis in a prototype bioreactor operating under similar hydrodynamic conditions, and the correlation between the local shear stress and tissue deposition on the cartilage constructs. This book provides new insights into the contribution of convective flow transport phenomena to cartilage development in vitro, and should be especially useful to bioengineers, students or anyone else who may be interested in biofluids, tissue engineering or mechanobiology.

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