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Experimental analysis of tissue growth in a perfusion bioreactor

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Tissue engineering consists in combining an absorbable scaffold with cells of interest and the proper culture medium in order to produce a tissue for medical purpose. In particular, bone tissue engineering steps in as a promising alternative to the current reference treatments auto and allografts [1].

The objective is two-fold: first, to understand how fluid flow in the porous scaffold of the bioreactor influences tissue growth, especially considering bead packing heterogeneities. We considered the specific behavior at the periphery and in the core of the porous scaffold. Second, to tackle the main mechanisms of tissue growth formation.

The most striking cell response to mechanotransduction [3] is the formation of a peripheral envelop around the beads packing, as a consequence of the well-described flow channeling effect [4]. More generally, local numerical simulations allowed us to understand the regions where the cells where more likely to proliferate. Further observations of the microCT images and histology slides of the tissue grown on two different materials and at different culture times allowed us to identify the main mechanisms of tissue formation, development and reorganization in the bioreactor.

References

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