

# MECHANICS OF ACTIVE POROUS MEDIA : BONE TISSUE ENGINEERING APPLICATION

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## Abstract

In orthopedics, a currently developed technique for large graft hybrid implants consists in using porous and biocompatible scaffolds seeded with patient's bone cells. Successful culture in such large implants remains a challenge for biologists and requires a strict control of the physico-chemical and mechanical environment achieved by perfusion within a bioreactor during several weeks. This perfusion with a nutritive fluid carrying solute ingredients is necessary for the active cells to grow, proliferate, differentiate and produce extra-cellular matrices. From the understanding and control of the processes leading to the substrate degradation and extra cellular matrix remodelling taking place during the *in vitro* culture phase, depends widely the success in the realization of new orthopaedic biomaterials. Within this context, the analysis of the interactions between convective phenomena of hydrodynamic origin and chemical reaction of biological order which are associated to these processes is a fundamental challenge in the framework of the bone tissue engineering. In order to better account for the different intricate processes taking place in such a sample and to design a relevant experimental protocol leading to the definition of an optimal tissue implant, we proposed a theoretical model based on transport phenomena in porous active media.