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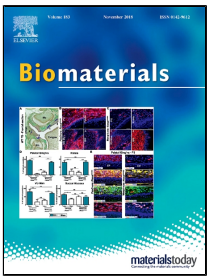

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Bone Physiology as Inspiration for Tissue Regenerative Therapies

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Abstract

The development, maintenance of healthy bone and regeneration of injured tissue in the human body comprise a set of intricate and finely coordinated processes. However, an analysis of current bone regeneration strategies shows that only a small fraction of well-reported bone biology aspects has been used as inspiration and transposed into the development of therapeutic products. Specific topics that include inter-scale bone structural organization, developmental aspects of bone morphogenesis, bone repair mechanisms, role of specific cells and heterotypic cell contact in the bone niche (including vascularization networks and immune system cells), cell-cell direct and soluble-mediated contact, extracellular matrix composition (with particular focus on the non-soluble fraction of proteins), as well as mechanical aspects of native bone will be the main reviewed topics. In this Review we suggest a systematic parallelization of (i) fundamental well-established biology of bone, (ii) updated and recent advances on the understanding of biological phenomena occurring in native and injured tissue, and (iii) critical discussion of how those individual aspects have been translated into tissue regeneration strategies using biomaterials and other tissue engineering approaches. We aim at presenting a perspective on unexplored aspects of bone physiology and how they could be translated into innovative regeneration-driven concepts.

Keywords: bone physiology; bone microenvironment; biomaterials; biomimetics