Nature-inspired nanostructured magnetic scaffolds for bone tissue engineering.

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The design and fabrication of advanced biocompatible and bioresorbable 3-D templates that mimic natural biologic structures constitute an important challenge in regenerative medicine. The size-dependent properties that offer the magnetic nanopartilcles (MNPs) and their incorporation into biocompatible scaffold formulations provides final materials with additional multifunctionality and reinforced mechanical properties for bone tissue engineering applications. Besides this biological implications, due to their magnetic character, the MNPs imbedded in the synthetic/natural scaffold formulations can act as heat-generating sources able to thermally activate the release of therapeutic compounds and growth factors, thus triggering cell behaviour (e.g. proliferation and differentiation)and promoting tissue regeneration. In this talk , I will comment on several different approaches to construct magnetic scaffolds with special hyperthermia properties which are of great interest for bone tissue engineering. An increase in the broken long bone's core temperature affects to the growth factor, thus facilitating the coalesce of broken bones. In my presentation, I will discuss the experimental details about the synthesis, magnetic hyperthermia (MH) of different superparamagnetic (SPM) core@shell NPs and biocompatible formulations containing magnetic iron oxide nanoparticles (magnetite) and hydroxyapatite (HA)- and mesoporous SBA-15 silica-based scaffolds. Magnetic nanocomposites formed by a biodegradable poly-ε-caprolactone (PCL) matrix and SPM iron-doped HA (FeHA) nanoparticles at different PCL/FeHA compositions have been also successfully prototyped, layer on layer, through 3-D bioplotting, which show interesting hyperthermia properties and cell proliferation.