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Bioceramics from calcium orthophosphates

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Various types of grafts have been traditionally used to restore damaged bones. In the late 1960's, a strong interest was raised in studying ceramics as potential bone grafts due to their biomechanical properties. A bit later, such synthetic biomaterials were called bioceramics. In principle, bioceramics can be prepared from diverse materials but this review is limited to calcium orthophosphate-based formulations only, which possess the specific advantages due to the chemical similarity to mammalian bones and teeth. During the past 40 years, there have been a number of important achievements in this field. Namely, after the initial development of bioceramics that was just tolerated in the physiological environment, an emphasis was shifted towards the formulations able to form direct chemical bonds with the adjacent bones. Afterwards, by the structural and compositional controls, it became possible to choose whether the calcium orthophosphate-based implants remain biologically stable once incorporated into the skeletal structure or whether they were resorbed over time. At the turn of the millennium, a new concept of regenerative bioceramics was developed and such formulations became an integrated part of the tissue engineering approach. Now calcium orthophosphate scaffolds are designed to induce bone formation and vascularization. These scaffolds are often porous and harbor different biomolecules and/or cells. Therefore, current biomedical applications of calcium orthophosphate bioceramics include bone augmentations, artificial bone grafts, maxillofacial reconstruction, spinal fusion, periodontal disease repairs and bone fillers after tumor surgery. Perspective future applications comprise drug delivery and tissue engineering purposes because calcium orthophosphates appear to be promising carriers of growth factors, bioactive peptides and various types of cells.

Biography

Sergey V Dorozhkin received his MS in Chemical Engineering with honors in 1984 from Moscow Institute of Chemical Technology, Moscow, Russia, and PhD in Chemistry in 1992 from Research Institute of Fertilizers, Moscow, Russia. From 1992 to 1994 he worked as a Senior Researcher at the same institute, and from 1994 to 1996 he worked as a biotechnologist at a Swiss-Russia joint venture. From 1996 to 2004 he held five temporary Postdoctoral positions on various aspects of calcium orthophosphates at five universities of four countries (France, Portugal, Germany and Canada). At present, he serves as a reviewer for several international scientific journals. He has authored more than 60 research papers, about 20 reviews, about 15 book chapters and 3 monographs.

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