Biomaterials: Merging Materials Science with Biology

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The last decade has seen a gradual evolution to include biological functionality in devices. Stent surfaces are modified to release Rapamycin; RGD and other peptides are immobilized on device surfaces to stimulate tissue formation. Herein, we will focus on biological functionality of orthopaedic devices from several perspectives. First, *in situ* biological functionalization will be invoked to explain the excellent tissue response of existing biomaterials, namely the class of bioactive ceramics. Second, biological functionality achieved by controlled delivery from sol gel nanoporous controlled release materials will be discussed.

Controlled release silica sol gels are room-temperature processed, porous, resorbable materials with excellent biocompatibility. Many molecules including drugs, proteins and growth factors can be released from sol gels and the quantity and duration of the release can vary widely. Processing parameters render these release properties exquisitely versatile. Based on a thorough understanding and an extensive control of release properties, various treatment modalities for unsolved clinical problems are advancing towards the clinic. They include the treatment of osteomyelitis, the treatment of surgical pain, the treatment of MRSA and the delivery of labile growth factors.