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on the Cell Spreading and Development; 3.3 Bioengineering; 3.3.1 The Basic Approach and Goals; 3.3.2 Tailored Surfaces for In Vitro Culturing of Cells; 3.3.2.1 A Modular Polymer Platform for Mechanically Regulated Cell Culturing at Interfaces 3.3.2.2 Regulation of Cell Fate by Nanostructured Surfaces 3.3.3 Three-Dimensional Scaffolds for Tissue Engineering; 3.3.4 Switchable Substrates and Matrices; References; 4 Whole-Cell Sensor Structures; 4.1 Case Studies; 4.2 Basic Principles; 4.3 Bioengineering; References; 5 Biohybrid Silica-Based Materials; 5.1 Case Studies; 5.2 Basic Principles; 5.2.1 Preparation of Silica-Based Xerogels; 5.2.2 Biological Properties of Silica-Based Biocers; 5.3 Bioengineering; 5.3.1 Bioactive Sol-Gel Coatings and Composites; 5.3.2 Biocatalytic Sol-Gel Coatings; 5.3.3 Bioremediation 5.3.4 Cell-Based Bioreactors 5.3.5 Silica-Based Controlled Release Structures; 5.3.6 Patterned Structures; 5.4 Silicified Geological Biomaterials; References; 6 Biomineralization; 6.1 Case Studies; 6.2 Basic Principles; 6.2.1 Precipitation; 6.2.1.1 Thermodynamics of Mineralization; 6.2.1.2 Kinetics of Mineralization; 6.2.2 Phenomenology of Biomineralization; 6.2.3 Basic Mechanisms in Biomineralization; 6.2.4 Biologically Mediated Mineralization: the Competition between Inhibition and Growth; 6.2.4.1 Effect of Polypeptides on Precipitate Habitus; 6.2.4.2 The Formation of Metastable Polymorphs 6.2.5 Biologically Induced Mineralization: Role of the Extracellular Space and the Extracellular Polymeric Substances

Sommario/riassunto

Bio-nanotechnology covers the development of novel techniques and materials by making use of the inspiration derived from biomolecular structures and processes. The progress in molecular biology and microbiology over the past 50 years has provided a solid basis for such development. Well characterized natural biomolecules as well as tailored recombinant proteins and tailored microorganisms obtained by genetic engineering provide a large "toolbox" for the implementation of biological structures in a technical environment. Biologically inspired mater
