

1. Record Nr.	UNINA9910829946603321
Autore	Cui Wenguo
Titolo	Biofabrication for orthopedics : methods, techniques and applications / / Wenguo Cui, Xin Zhao, and Shen Liu
Pubbl/distr/stampa	New York, NY : , : John Wiley & Sons, Inc., , [2022] ©2022
ISBN	3-527-83137-1 3-527-83135-5
Descrizione fisica	1 online resource (669 pages)
Disciplina	610.28
Soggetti	Biomedical engineering Tissue engineering
Lingua di pubblicazione	Inglese
Formato	Materiale a stampa
Livello bibliografico	Monografia
Nota di contenuto	Cover -- Title Page -- Copyright -- Contents -- Foreword from Prof. Changsheng Liu -- Foreword from Prof. Yingze Zhang -- Foreword from Prof. Lianfu Deng -- Foreword from Prof. Cato T. Laurencin -- Preface -- Volume-1 -- Part I Biofabrication Techniques -- Chapter 1 Current Progress and Technological Challenges in Translational 3D Bioprinting -- 1.1 Introduction -- 1.2 Challenges in the 3D Bioprinting Process -- 1.2.1 Manufacturing Challenges -- 1.2.1.1 Choice of Bioink -- 1.2.1.2 Cell Selection and Optimization -- 1.2.1.3 Printing Resolution and Mechanical Stability -- 1.2.1.4 Design and Post processing -- 1.2.2 In Vitro Challenges -- 1.2.2.1 Cell Viability -- 1.2.2.2 Cell Differentiation -- 1.2.3 Clinical Challenges -- 1.2.3.1 Remodeling and Maturation -- 1.2.3.2 Immune Response -- 1.2.3.3 Vascularization -- 1.2.3.4 Innervation -- 1.3 Conclusion and Future Perspectives -- Acknowledgments -- References -- Chapter 2 Bioceramics for Promoting Bone Regeneration -- 2.1 Introduction -- 2.2 Types of Bioceramics -- 2.2.1 Bioactive Ceramics -- 2.2.2 Biodegradable Ceramics -- 2.2.2.1 Bioactive Glass -- 2.2.2.2 Tricalcium Phosphate -- 2.2.2.3 Calcium Phosphate Cements -- 2.2.2.4 Silicate Bioceramics -- 2.3 Mechanical Properties -- 2.4 Biological Properties -- 2.4.1 Protein Adsorption -- 2.4.2 Immunomodulation -- 2.4.3 Vascularization -- 2.5 Summary --

Acknowledgments -- References -- Chapter 3 3D Printing and Bioprinting Strategies Applied Toward Orthopedics -- 3.1 Introduction -- 3.2 Biomaterial Inks -- 3.2.1 Hydrogel Biomaterial Inks -- 3.2.1.1 Collagens -- 3.2.1.2 Gelatin -- 3.2.1.3 Alginate -- 3.2.1.4 Hyaluronic Acid -- 3.2.2 Thermoplastic Polymeric Inks -- 3.2.2.1 PCL -- 3.2.2.2 PLA -- 3.2.2.3 Polyetheretherketone (PEEK) -- 3.2.3 Calcium Phosphate (CaP) Ceramic Inks -- 3.2.4 Supramolecular and StimuliResponsive Inks.

3.3 3D Printing and Bioprinting Techniques -- 3.3.1 ExtrusionBased (Bio)printing -- 3.3.2 InkjetBased (Bio)printing -- 3.3.3 LightBased (Bio)printing -- 3.4 Current Challenges and Future Directions --

Acknowledgments -- References -- Chapter 4 Stem Cells and Their Application in Orthopedics -- 4.1 Introduction -- 4.2 Mesenchymal Stem Cells (MSCs) -- 4.2.1 Tissue Sources of MSCs -- 4.2.2 Isolation, Identification, and Expansion of MSCs -- 4.2.3 Current Cell Markers for MSC Identification -- 4.2.3.1 Differentiation of MSCs both In Vitro and In Vivo -- 4.3 MSCDerived Extracellular Vesicles (MSCEVs) and Exosomes -- 4.4 Clinical Application of Stem Cells in Orthopedics -- 4.4.1 Bone Defects, Nonunion, and Osteogenesis Imperfecta -- 4.4.1.1 Bone Nonunion and Defects -- 4.4.1.2 Osteogenesis Imperfecta (OI) -- 4.4.2 Osteochondral Defect and Osteoarthritis (OA) -- 4.4.3 Tendon and Ligament Injury -- 4.4.3.1 Rotator Cuff Tear -- 4.4.3.2 Anterior Cruciate Ligament (ACL) Reconstruction -- 4.4.4 Spine -- 4.4.4.1 Spinal Fusion -- 4.4.4.2 Spinal Cord Injuries (SCI) -- 4.5 Considerations of Stem Cells and Derivations for Clinical Usage -- 4.6 Conclusion --

Acknowledgments -- Abbreviations -- References -- Chapter 5 Electrospinning Techniques -- 5.1 Introduction -- 5.2 Different Types of Electrospinning Techniques -- 5.2.1 Traditional Electrospinning -- 5.2.2 Coaxial Electrospinning -- 5.2.3 Emulsion Electrospinning -- 5.2.4 Conjugated Electrospinning -- 5.2.5 Dynamic Liquid Electrospinning -- 5.2.6 Multifluid Electrospinning -- 5.2.7 Electrosprun Fibers Integrated with Posttreatments -- 5.2.7.1 Coating Physical Components on the Fibers -- 5.2.7.2 Deposition of Electrosprayed Microparticles on the Fibers -- 5.2.7.3 Welding of Nanofibers -- 5.2.7.4 Remolding Electrosprun Nanofibers to 3D Scaffolds -- 5.3 Typical Applications of Electrosprun Fibers in Orthopedics.

5.3.1 Bone Tissue Repair -- 5.3.2 Vascularization -- 5.3.3 Cartilage Repair -- 5.3.4 Tendon and Ligament Repair -- 5.3.5 Repair of TendontoBone Interface -- 5.4 Conclusion and Future Outlook --

References -- Chapter 6 Joint Lubrication and Wear -- 6.1 Introduction -- 6.2 Natural Joint Structure -- 6.2.1 Role of Articular Cartilage -- 6.2.2 Regional Classification of Articular Cartilage -- 6.3 Joint Lubrication Mechanism -- 6.3.1 Tribological Theory -- 6.3.2 Hydration Lubrication -- 6.4 Joint Lubrication Behavior -- 6.4.1 Component -- 6.4.2 Lubrication Performance -- 6.5 Artificial Biolubricants -- 6.6 Artificial Joint Prosthesis -- 6.6.1 Metal Material -- 6.6.2 Polymer Material -- 6.6.3 Ceramic Material -- Acknowledgments -- References -- Chapter 7 Microfluidic Biotechnology for "BoneonaChip" -- 7.1 Introduction -- 7.2 Basic Principles and Properties of Microfluidics -- 7.2.1 Fabrication of Microfluidic Devices via Soft Lithography -- 7.2.2 Fluid Controlling Components of Microfluidic Devices -- 7.2.2.1 Microvalves -- 7.2.2.2 Micropumps -- 7.2.2.3 Micromixers -- 7.2.2.4 Concentration Gradient -- 7.2.3 Cell/Tissue Culture in Microfluidic Devices -- 7.3 Microfluidic "OrganonaChip" Technology -- 7.3.1 Organ-on-a-Chip: Overview -- 7.3.2 Biological Features of Organona Chip Devices -- 7.3.2.1 Tissue Barrier Functions -- 7.3.2.2 External Stimulation -- 7.3.2.3 Microvascular Network -- 7.3.3 Recent Advances

in "BoneonaChip" Technology -- 7.3.4 Mineralization and Osteogenesis -- 7.3.5 Osteochondral Tissue -- 7.3.6 Bone Marrow -- 7.3.7 Cancer -- 7.4 Conclusion and Future Perspectives -- Acknowledgments -- References -- Chapter 8 Bioactive Glasses in Orthopedics -- 8.1 First Bioactive Glass -- 8.2 Bioactive Glass Versatility -- 8.2.1 Osteogenesis -- 8.2.2 Angiogenesis -- 8.2.3 Antimicrobial Activity -- 8.3 Alternative Bioactive Glasses. 8.4 Bioactive Glasses in Composites and Hybrid Materials -- 8.4.1 Materials Used as Organic Phase in Composites or Hybrid Devices for Bone Repair -- 8.4.1.1 Natural Polymers -- 8.4.1.2 Synthetic Polymers -- 8.4.2 Composite Materials -- 8.4.2.1 Bioactive Glasses Used in Composites -- 8.4.2.2 Bioactive Glass Influence on Cell Behavior In Vitro -- 8.4.2.3 Composites' Fabrication Methods -- 8.4.3 Hybrid Materials -- 8.4.4 Composites in Clinics -- 8.5 Conclusion -- Acknowledgments -- References -- Volume-2 -- Part II Biomedical Applications in Orthopedics -- Chapter 9 3D Printing for Orthopedics -- 9.1 Overview of 3D Printing Technology -- 9.2 Bone Tissue Engineering and 3D Printing -- 9.3 Cartilage Tissue Engineering and 3D Printing -- 9.4 Structural Requirements of 3D Printing -- 9.4.1 Pore Size -- 9.4.2 Porosity -- 9.4.3 Pore Structure -- 9.5 Biomaterials for 3D Printing -- 9.5.1 Metal -- 9.5.2 Bioceramics -- 9.5.3 Polymer Materials -- 9.6 Application of 3D Printing in Cell Printing and Orthopedic Tissue Engineering -- 9.6.1 Inkjet 3D Printing -- 9.6.2 ExtrusionBased 3D Bioprinting -- 9.6.3 LaserAssisted Printing -- 9.7 Future Prospects -- Acknowledgments -- References -- Chapter 10 Bone Implants (Bone Regeneration and Bone Cancer Treatments) -- 10.1 Bone Regeneration -- 10.1.1 Introduction -- 10.1.2 Biological Characteristics of Bone -- 10.1.2.1 Bone Biology -- 10.1.2.2 Osteogenesis and Bone Healing (Biominerilization) -- 10.1.3 Role of Implants for Bone Regeneration -- 10.1.3.1 Providing Structural Support -- 10.1.3.2 Regulating Stem Cell Behaviors -- 10.1.3.3 Activating GeneAssociated Therapy -- 10.1.3.4 Application of Orthobiologics -- 10.1.3.5 Generating Stimulus Responses for Bone Healing -- 10.1.3.6 Converging Multiple Synergistic Strategies -- 10.1.4 Concluding Remarks and Future Outlook -- 10.2 Bone Cancer Treatments. 10.2.1 Clinical Approach to Bone Cancer -- 10.2.1.1 Introduction -- 10.2.1.2 Traditional Approaches -- 10.2.1.3 Surgery -- 10.2.1.4 Chemotherapy -- 10.2.1.5 Radiotherapy -- 10.2.1.6 Molecular Targetede Therapy -- 10.2.1.7 Other Therapy -- 10.2.2 StateoftheArt Nanotechnology -- 10.2.2.1 Nanotechnology for Bone Cancer Therapy -- 10.2.2.2 Cytotoxic Agents -- 10.2.2.3 Drug Delivery Platform -- 10.2.2.4 Phototherapy -- 10.2.2.5 Gene Therapy -- 10.2.2.6 Summary and Future Direction -- 10.2.3 Biofabrication for Bone Cancer Treatments -- 10.2.3.1 Introduction -- 10.2.3.2 Application in Bone Cancer Treatments -- 10.2.3.3 Summary and Future Direction -- Acknowledgments -- References -- Chapter 11 Bionic Fixation: Design, Biomechanics, and Clinical Application -- 11.1 Bionics and Medical Bionics -- 11.2 Structural Bionics in the Field of Orthopedics and Traumatology -- 11.2.1 Elastic Bionic Fixation Device for Distal Tibiofibular Syndesmosis -- 11.2.2 Minimally Invasive Adjustable Plate for Pelvic Fractures -- 11.2.3 Bionic Implants for Intertrochanteric Fracture of the Femur -- 11.2.4 Bionic Fixation of Calcaneal Fracture -- 11.3 Bionic Materials -- 11.3.1 Application and Designation of New Composite Materials -- 11.3.2 Bionic Design -- 11.4 Future Perspectives and Current Limitations -- Acknowledgments -- References -- Chapter 12 Cartilage Injury and Repair -- 12.1 Introduction -- 12.2 Pathology of Cartilage Injury -- 12.3 Clinical

Characteristics of Cartilage Injury -- 12.4 Evaluation of Cartilage Injuries -- 12.4.1 Arthroscopic Evaluation of Cartilage Injury -- 12.4.2 Histopathology Evaluation of Cartilage Injury -- 12.4.3 Magnetic Resonance Imaging (MRI) Assessment of Cartilage Injury -- 12.5 Clinical Strategies of Cartilage Repair -- 12.5.1 Debridement, Cartilage Shaving, and Joint Lavage -- 12.5.2 Bone Marrow Stimulation and Augmentation.  
12.5.3 Osteochondral Autografts and Allografts.

---