

1. Record Nr.	UNINA9911020153703321
Autore	Saha Prosenjit
Titolo	3D Bioprinting from Lab to Industry
Pubbl/distr/stampa	Newark : , : John Wiley & Sons, Incorporated, , 2024 ©2024
ISBN	9781119894407 1119894409 9781119894384 1119894387
Edizione	[1st ed.]
Descrizione fisica	1 online resource (531 pages)
Altri autori (Persone)	ThomasSabu KimJinku GhoshManojit
Disciplina	610.285
Soggetti	Tissue engineering Regenerative medicine
Lingua di pubblicazione	Inglese
Formato	Materiale a stampa
Livello bibliografico	Monografia
Nota di contenuto	Cover -- Title Page -- Copyright Page -- Contents -- List of Contributors -- Foreword -- Chapter 1 Introduction of 3D Printing and Different Bioprinting Methods -- 1.1 Introduction of 3D Printing: Principles and Utility -- 1.2 Ink Preparation and Printability -- 1.3 Methods of Bioprinting in Fabrication and Tissue Engineering -- 1.3.1 Laser-Based Printing -- 1.3.1.1 Types of Laser Printing -- 1.3.2 Extrusion-Based Printing -- 1.3.3 Droplet Printing -- 1.3.4 Inkjet-Based Printing -- 1.3.5 Stereolithography 3D Printing -- 1.4 Scaffold Modeling and G Coding -- 1.4.1 Scanning Technology -- 1.4.2 CT Imaging -- 1.4.3 MRI Scanning -- 1.4.4 Preferred Accuracy Parameters for Scanning -- 1.4.5 Biomodeling Process for RP -- 1.5 Applications and Utility in Large-Scale Manufacturing -- 1.5.1 Bone -- 1.5.2 Cartilage -- 1.5.3 Skin -- 1.5.4 Vascular Grafts -- 1.5.5 Heart -- 1.5.6 Lungs -- 1.5.7 Liver -- 1.5.8 Kidney and Urethra -- 1.5.9 Brain and Spinal Cord -- 1.5.10 Cornea -- 1.5.11 Therapeutics -- 1.6 Complications and Troubleshooting -- 1.6.1 Laser-Based Printing -- 1.6.2 Inkjet-Based Printing -- 1.6.3 Extrusion-Based Printing -- 1.6.4

Droplet Printing -- 1.6.5 Stereolithography 3D Printing -- References -- Chapter 2 Cellular Requirements and Preparation for Bioprinting -- 2.1 Introduction -- 2.2 Types of Bioprinting -- 2.2.1 Inkjet-Assisted Printing -- 2.2.2 Extruder-Assisted Printing -- 2.2.3 Laser-Assisted Bioprinting -- 2.3 Features Required for Bioprinting with Cells -- 2.3.1 Sterility Parameters -- 2.3.2 Printing Speed and Pressure -- 2.3.3 pH and Osmotic Condition -- 2.3.4 Hydrogel Generation -- 2.3.4.1 Natural Polymers -- 2.3.4.2 Synthetic Polymers -- 2.3.5 Culture Duration and Conditions -- 2.3.6 Rheological Properties -- 2.4 Bioprinting Methodologies for Cell Expansion and Proliferation. 2.5 The Impact of Bioprinting Process Conditions on Phenotype Alterations -- 2.5.1 Bioprinting Techniques for Stem Cell Differentiation -- 2.5.1.1 Bioprinting Strategies for Cellular Environment Alterations -- 2.5.1.2 Bioprinting Strategies for Cell Behavior Modulation -- 2.5.1.3 Bioprinting Strategies for Genetic Modulation and Transcriptomics Variation -- 2.5.2 Bioprinting Techniques for Tumorigenic Differentiation -- 2.5.2.1 Bioprinting Strategies for Oncogenic Cell Growth -- 2.5.2.2 Bioprinting Strategies for the Development of Tumor Models -- 2.6 Discussion -- 2.7 Conclusion -- 2.8 Future Prospects -- References -- Chapter 3 3D Bioprinting: Materials for Bioprinting Bioinks Selection -- 3.1 Introduction -- 3.2 Bioprinting Materials -- 3.2.1 Biomaterials -- 3.2.2 Cells -- 3.2.3 Biomolecules or Additive Molecules -- 3.2.4 Hydrogels -- 3.3 Bioinks Selectivity Guide -- 3.3.1 Printability of Materials -- 3.3.2 Material Biocompatibility -- 3.3.3 Structural Properties -- 3.3.4 Materials Degradation -- 3.3.5 Biomimicry -- 3.4 Classification of Bioprinting Materials -- 3.4.1 According to Material Type -- 3.4.1.1 Polymers -- 3.4.1.2 Nanocomposites -- 3.4.1.3 Nanoparticles -- 3.4.2 According to Cell Dependence -- 3.4.2.1 Cell-based Bioinks -- 3.4.2.2 Cell-Free Bioinks (Biomaterial Inks) -- 3.5 3D Bioprinting Methods According to the Type of the Bioinks -- 3.5.1 Extrusion-Based 3D Bioprinting -- 3.5.2 Inkjet 3D Bioprinting -- 3.5.3 Stereolithography 3D Bioprinting -- 3.5.4 Laser-Based 3D Bioprinting -- 3.5.5 Bioplotting -- 3.6 Bioinks Selection According to Biomedical Application -- 3.7 Multicomponent Bioinks -- 3.8 Future Prospects -- References -- Chapter 4 Printed Scaffolds in Tissue Engineering -- 4.1 Introduction -- 4.2 Biomedical Application of 3D Printing -- 4.2.1 Implants and Scaffolds -- 4.2.2 Drug Delivery/Drug Modeling Application. 4.2.3 Applications of 3D Printed Scaffolds During COVID-19 -- 4.3 Tissue Engineering: Emerging Applications by 3D Printing -- 4.3.1 Cartilage Tissue Engineering by Printed Scaffolds -- 4.3.2 Liver Tissue Engineering by Printed Scaffolds -- 4.3.3 Nerve Tissue Engineering by Printed Scaffolds -- 4.3.4 Cardiac Tissue Engineering by Printed Scaffolds -- 4.4 Conclusions -- References -- Chapter 5 Printability and Shape Fidelity in Different Bioprinting Processes -- 5.1 Introduction -- 5.2 Fundamentals of Printability -- 5.3 Bioprinting Techniques and Printability -- 5.3.1 Extrusion-Based Bioprinting -- 5.3.2 Inkjet-Based Bioprinting -- 5.3.3 Stereolithography-Based Bioprinting (SL) -- 5.4 Shape Fidelity -- 5.4.1 Shape Fidelity in Planar Structures -- 5.4.2 Shape Fidelity in Multilayered Structures -- 5.4.3 Characterization Approaches -- 5.4.3.1 Rheological Characterization -- 5.4.3.2 Mechanical Characterization -- 5.4.3.3 Swelling Test -- 5.4.3.4 Viability Characterization -- 5.4.3.5 Bioprinting Procedure -- 5.5 Case Studies and Applications -- 5.6 Conclusion -- References -- Chapter 6 Advancements in Bioprinting for Medical Applications -- 6.1 Introduction -- 6.2 Bioprinting for Drug Development and Testing -- 6.2.1 Overview -- 6.2.2 3D Bioprinted Organoids -- 6.2.3 Organ-on-a-Chip/Microfluidic Systems -- 6.2.4 Bioprinted Models for Cancer

Research -- 6.2.5 3D Bioprinting for Immunotherapy and Cell Therapy
 -- 6.3 Bioprinting in Tissue Engineering, Regenerative Medicine,
 and Organ Transplantation -- 6.3.1 Ocular Tissue Engineering --
 6.3.1.1 Retina -- 6.3.1.2 Cornea -- 6.3.2 Neural Tissue -- 6.3.3 Skin
 -- 6.3.3.1 Disease and Pharmaceutical Studies -- 6.3.3.2 Wound
 Healing -- 6.3.3.3 Reconstructive Surgery -- 6.3.4 Cartilage and Bone
 -- 6.3.4.1 Cartilage Printing Modalities -- 6.3.4.2 Cartilage
 Regeneration -- 6.3.5 Vascular Tissue.
 6.3.6 Cardiac Tissue Engineering -- 6.3.7 Pancreas -- 6.3.7.1
 Modulating Bioink Formulation to Enhance Tissue Viability -- 6.3.7.2
 Controlling Other Printing Parameters to Enhance Tissue Viability --
 6.3.7.3 Using Printed Models to Study Pancreatic Cancer -- 6.3.8 Liver
 -- 6.3.8.1 Developing Suitable In Vitro Models -- 6.3.9 Lungs --
 6.3.9.1 Developing Suitable In Vitro Models -- 6.3.9.2 Application of
 3D Construct -- 6.3.10 Renal/Kidney -- 6.3.10.1 Printing Parameters
 Affecting the Viability of Printed Model -- 6.3.10.2 Applications of 3D-
 Printed Model -- 6.3.11 Composite Tissues -- 6.3.12 Other Tissues --
 6.4 Bioprinting in Tissue: Challenges, Barriers to Clinical Translation,
 and Future Directions -- 6.4.1 Introduction -- 6.4.1.1 Current
 Challenges in Organ Transplantation -- 6.4.1.2 Potential of Bioprinted
 Organs for Transplantation -- 6.4.1.3 Challenges and Limitations in
 Bioprinting Tissues and Organs -- 6.4.2 Insight on Barriers to Clinical
 Translation of Bioprinting Technology -- 6.4.3 Future Directions -- 6.5
 Conclusions -- Acknowledgments -- References -- Chapter 7 4D-
 Printed, Smart, Multiresponsive Structures and Their Applications --
 7.1 Introduction -- 7.2 4D-Printing Technologies -- 7.3 Biomaterials
 for 4D Bioprinting -- 7.3.1 Water-Responsive Polymers -- 7.3.2
 Temperature-Responsive Polymers (Hydrogels) -- 7.3.3
 Electrical/Magnetic-Responsive Polymers -- 7.4 Biomedical
 Applications for 4D Bioprinting -- 7.4.1 Limitations of 3D Bioprinting
 -- 7.4.2 Biomedical Applications of 4D Printing -- 7.4.3 Scaffold
 Preparation -- 7.4.4 Drug Delivery -- 7.4.5 Sensors -- 7.4.6 Medical
 Devices -- 7.4.7 Tissue Engineering and Organ Regeneration -- 7.5
 Future Perspectives -- References -- Chapter 8 Toxicity Aspects and
 Ethical Issues of Bioprinting -- 8.1 Introduction -- 8.2 Toxicity Issues
 in Bioprinting -- 8.2.1 Cell Harvesting and Culture.
 8.2.2 Aseptic Techniques in Bioprinting -- 8.3 Ethical Issues
 in Bioprinting -- 8.3.1 Purpose -- 8.3.2 Cell Source -- 8.3.3 Data
 and Consent -- 8.3.4 Safety -- 8.3.5 Cost and Equity -- 8.3.6
 Reproductive Organs -- 8.4 Issues in Clinical Trials -- 8.4.1
 Personalized Treatment -- 8.4.2 Inability to Withdraw or Access
 Alternate Treatments -- 8.5 Legal Issues in Bioprinting -- 8.5.1
 Intellectual Property Rights and Product Classification -- 8.5.2 Lack
 of Regulatory Guidelines -- 8.6 Conclusion -- References -- Chapter 9
 Planning Bioprinting Project -- 9.1 Introduction -- 9.2 Background:
 Image Capturing and Solid Model Preparation of Virtual Anatomical
 Model for 3D Printing -- 9.2.1 Other Imaging Techniques -- 9.2.2
 Digital Process for STL Generation -- 9.2.3 Blueprint Modeling -- 9.2.4
 CAD-Based Systems Characteristics -- 9.2.5 Image-Based Systems --
 9.2.6 Freeform Systems -- 9.2.7 Designs Using Implicit Surfaces --
 9.2.8 Space-Filling Curves -- 9.2.9 Planning of Toolpath for Bioprinting
 -- 9.2.10 Cartesian Form Toolpath Planning -- 9.2.11 Parametric Form
 in Toolpath Planning -- 9.2.12 Bioprinting Methods -- 9.2.12.1
 Extrusion Bioprinting -- 9.2.12.2 Inkjet Printing -- 9.2.12.3 Laser-
 Assisted Printing -- 9.3 Conclusion -- References -- Chapter 10
 Computational Engineering for 3D Bioprinting: Models, Methods, and
 Emerging Technologies -- 10.1 Introduction -- 10.2 Fundamentals
 of Numerical Methods in Bioprinting -- 10.2.1 Finite Element Analysis

-- 10.2.2 Computational Fluid Dynamics -- 10.2.3 Agent-Based Modeling -- 10.2.4 Lattice Boltzmann Method -- 10.2.5 Molecular Dynamics -- 10.3 Application of Machine Learning for 3D Bioprinting -- 10.4 Summary -- References -- Chapter 11 Controlling Factors of Bioprinting -- 11.1 Introduction -- 11.2 Factors Influencing the Printability of Hydrogel Bioink -- 11.2.1 Extrudability -- 11.2.2 Filament Type. 11.2.3 Shape Fidelity.

Sommario/riassunto

This book, "3D Bioprinting from Lab to Industry," explores the principles, methods, and applications of 3D bioprinting technology. It covers a range of bioprinting methods, including laser-based, extrusion, droplet, and inkjet printing, emphasizing their utility in tissue engineering and large-scale manufacturing of biological constructs. The book delves into the preparation and printability of bioinks, the selection of biomaterials, and the challenges associated with bioprinting, such as sterility and print fidelity. It addresses the use of 3D bioprinting for medical applications, including drug development, tissue engineering, and organ regeneration. The text aims to bridge the gap between laboratory research and industrial applications, making it suitable for researchers, professionals, and students in biomedical engineering, tissue engineering, and regenerative medicine.
