3D BIOPRINTING

Fundamentals, Principles and Applications

Ibrahim T. Ozbolat

Against the backdrop of the urgent need to bridge the gap between organ shortage and transplantation needs, ***3D Bioprinting*** guides the reader through the game-changing role of 3D printing in tissue engineering. ***3D Bioprinting*** covers almost all aspects of bioprinting, spanning raw materials, processes, machine technology, products, applications, limitations, and future perspectives. From the basics of 3D bioprinting, through to organ printing and on to likely future trends such as 4D bioprinting and bioprinting de novo organs, it provides a thorough description of the various bioprinting processes and technologies used in the 3D bioprinting of tissues and organs using living cells. It also details the components of bioprinting from the design phase to the tissue maturation and implantation phases.

Key Features

- Each of the three major bioprinting techniques is covered: Extrusion-based bioprinting; Droplet-based bioprinting; and Laser-based bioprinting, along with an analysis of their advantages and limitations.
- All currently available bioink materials that are used in bioprinting, including hydrogels, cell aggregates, decellularized matrix components and microcarriers, are discussed, their physical, chemical and biological properties, and compatible bioprinting techniques are expounded, and their strengths and limitations are compared.
- Provides an analysis of promising directions for creating viable end-products in the construction of three-dimensional (3D)-vascularized whole organs, which remains the main technological barrier to be overcome.

3D Bioprinting provides practical guidance for bioengineers, tissue and manufacturing engineers as well as medical doctors. It enables them to understand the features of each bioprinting process, the bioink and bioprinter type, and then to select the appropriate process for a given application such as tissue engineering and regenerative medicine, transplantation, clinics or pharmaceutics.

3D Bioprinting is also a comprehensive resource that professionals, academics, students, and researchers in biomedical engineering, tissue engineering, manufacturing engineering, industrial engineering, medical, pharmaceutical and 3D printing industries can consult.

About the Author

Ibrahim T. Ozbolat, Associate Professor, Dept. of Engineering Science and Mechanics, Dept. of Biomedical Engineering, The Huck Institutes of the Life Sciences, Penn State University, University Park, USA.

Dr. Ozbolat is also affiliated to the Center for Neural Engineering, the Center for Innovative Materials Processing through Direct Digital Deposition and the Center for Research on Advanced Fiber Technologies at the Penn State University. **Dr. Ozbolat** has participated in spin-off companies, including Virtual Systems Engineering, LLC. and BioPrint, LLC. **Dr. Ozbolat's** major research focus is in the area of Bioprinting and Tissue Engineering, and he has been recognized for his research on bioprinting with several prestigious awards including the International Outstanding Young Researcher in Freeform and Additive Manufacturing Award (2015), the Hamed K. Eldin Outstanding Early Career Industrial Engineer in Academia Award (2015), the Society of Manufacturing Engineers Outstanding Young Manufacturing Engineer Award (2014), the National Science Foundation CAREER Award (2014), the American Society of Mechanical Engineers (ASME) Chao and Trigger Young Manufacturing Engineer Award (2014), and the ASME Pi Tau Sigma Gold Medal (2014).

Image Credit "Christopher Barnatt, ExplainingTheFuture.com"

ELSEVIER

ACADEMIC PRESS

An imprint of Elsevier

elsevier.com

ISBN 978-0-12-803010-3