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Editorial

Editorial Note on: Bio Printing

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EDITORIAL

Three-dimensional (3D) printing has attracted increasing interest during the last decades and is already used in various industrial sectors for the rapid and easy fabrication of complex structures and materials, exceeding several limitations of conventional manufacturing techniques. 3D printing, also known as additive manufacturing has also led to remarkable advances in the healthcare sector (3D bio printing), especially in regenerative medicine, as it facilitates on-demand "printing" of cells, tissues and organs. These technological advances have led to the creation of new scientific fields such as "tissue engineering".

Developments in 3D bio printing have been mostly motivated by the limited availability of organs globally, which are needed for the rehabilitation of lost or failed organs and tissues. The most challenging and demanding applications for engineered tissues include the skin, cartilage hard tissues such as bones, cardiac tissue, and vascular grafts.

Medical modelling is another field where 3D printing is increasingly being applied. In clinical practice, 3D printed models have been shown to be useful for surgical planning and medical education The use of 3D printing to develop tools to assist and improve medical procedures has a long history, and the Centre for Devices and Radiological Health at the Food and Drug Administration has reviewed and cleared several 3D printed medical devices over the last 10 years.

After the first developments in 3D printing, which was described as "stereo lithography" by Charles W. Hull in the early 1980s, new methods and techniques for the construction of 3D objects have been developed and used for educational, research and even clinical purposes. Initially, stereo lithography, also termed photo-solidification, optical fabrication or resin printing, was used to form 3D structures using sequentially printed thin layers of a material processed by ultraviolet light. Various additive manufacturing techniques have since been developed for the automated production of personalized, computer-modelled tissue replicas and even organs.

In general, bio fabrication can be defined as "the automatedgeneration of biologically functional products with structural organization from living cells, bioactive molecules, biomaterials, cell aggregates such as micro tissues, hybrid cell-material constructs through bio printing or bio assembly". The definition of bio fabrication has been further refined to include "bio printing" and "bio assembly" as complementary parts of the bio fabrication process. A major challenge for 3D printing technologies is the construction of medical devices and biological tissues and organs. Bio printing is defined as the positioning of bio chemicals, biological materials, and living cells for the generation of bioengineered structures (i.e. additive manufacturing) of biological and biologically relevant materials with the use of computer-aided transfer and build-up processes. Typical 3D printing techniques have further evolved with the creation of sacrificial resin moulds for the formation of 3D scaffolds from biological materials. The development of solvent-free, aqueous-based systems has facilitated the printing of biomaterials into 3D scaffolds that can be used for transplantation with or without seeded cells. The next milestone was 3D bio printing, namely the formation of tissue engineered structure.

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