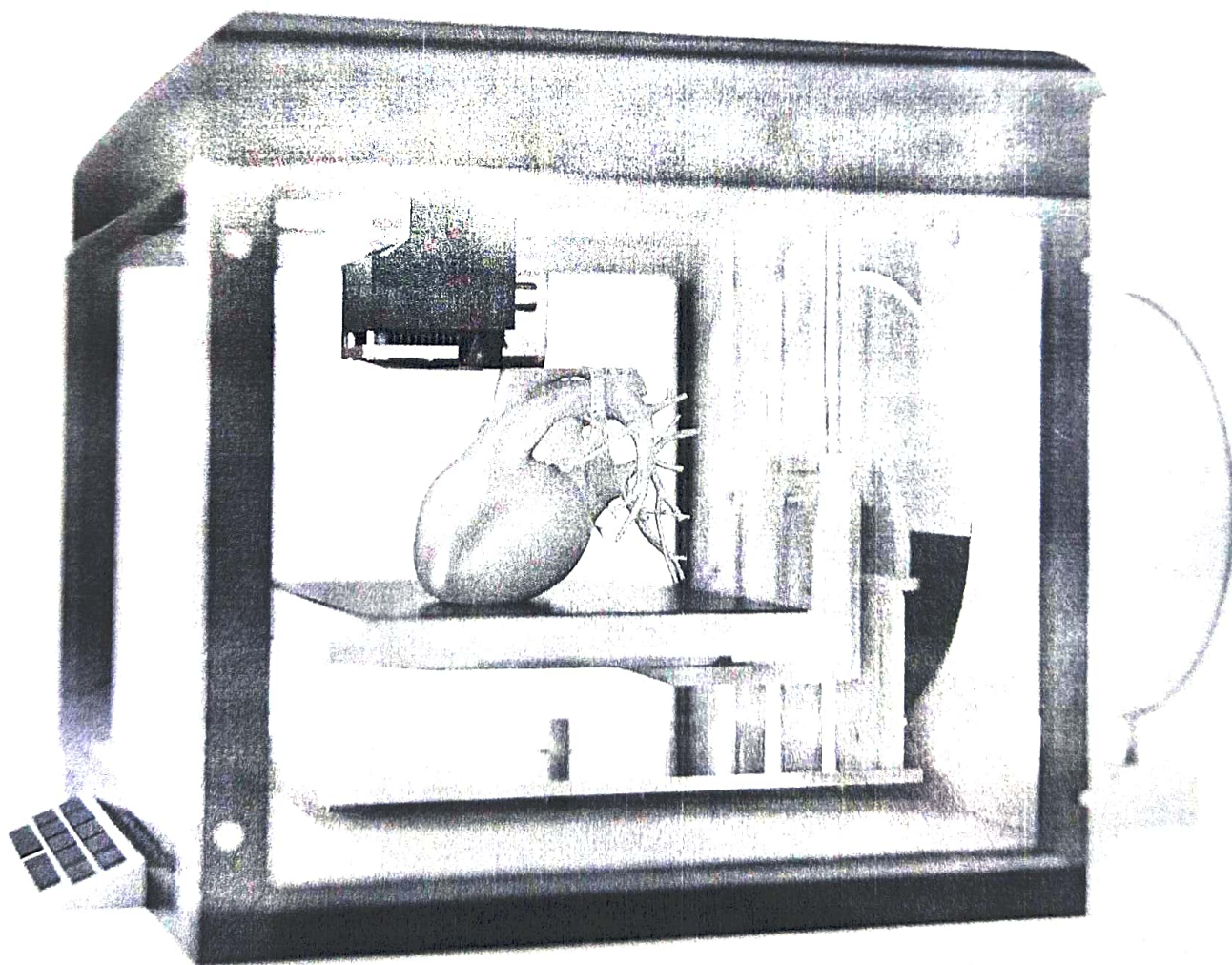


# Handbook of 3D Printing in Biomedical Applications

Edited by A.N. Aafa, Mohamad Zaki Hassan,  
and R.A. Ilyas



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# 1 Fundamental Concepts of Additive Manufacturing in the Biomedical Field

*Prashant Upadhyay, Shivani Agarwal,  
Rahul Chauhan, and Sukirti Upadhyay*

## 1.1 INTRODUCTION

Additive manufacturing (AM) is a modern assembling cycle to create complex three-dimensional (3D) structures by keeping different materials in a layer-by-layer way. In AM, the craft of creation consistently combines with the accuracy of innovation. This innovation has revolutionized numerous modern fields and, as a result, AM has gained recognition in the biomedical field for its potential to transform the medical care sector by revolutionizing the production of clinical devices. AM plays a significant role in advancing the development of patient-specific devices such as muscle inserts and dental restorations. AM uses patient-explicit imaging data from CT, X-ray, or X-beam to make highly customized decisions (Pothala and Raju 2023). For example, 3D printing allows people to make inserts with porous designs that help bones fuse together or break with the surrounding insert, which improves health and long-term success (Mukherjee et al. 2023; Yuan et al. 2019). Moreover, devices can incorporate intricate internal channels to accelerate the flow, a necessary step for enhancing 3D tissue models that include vasculature. These channels likewise support many materials that are biocompatible. AM promotes the use of a diverse range of materials, including polymers, pottery, metals, compounds, biomaterials, and cells. This variety considers the advancement of clinical devices that intently copy or support human tissues and organs. For example, bioprinting (a type of AM process) allows the creation of 3D frameworks made of living cells and organic materials. These frameworks can be used for tissue design, drug screening, and regenerative medicine. Also, innovation considers the consolidation of drugs or development factors into clinical gadgets, empowering limited and controlled drug conveyance (Auriemma et al. 2022). The AM standards had a significant impact on biomedical applications. A few remarkable applications show restraint-explicit inserts, such as muscular inserts for cranial inserts, prosthetics, amplifiers, and dental recreation. It has also grown in careful preparation and execution, with 3D-printed life structure models assisting specialists with imagining testing cases, which improved preoperative preparation and worked on careful results (Thieringer et al. 2022). The future