

A Review of Key Research and Development Opportunities in the Technological Advancements of Bioprinting

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Bioprinting technology has shown a swift development within the last decade. However, the fundamental limitations of bioprinting technology still need to be addressed. This review aimed to identify limitations, the rationale behind them, the current approaches to solve them, and proposes novel methodologies to address these challenges. The data were collected from several databases, using different combinations of keywords in metadata to precisely identify the technological limitations. The collection was analyzed in depth. The literature in several disciplines ranging from 3D bioprinting, 3D printing, machine learning, stem cell technology, cell biology and transplant medicine, and biomaterials was used to identify the major limitations, current trends, and deficits in the current approaches to overcome the fundamental limitations. From the analysis, the leading three 3D bioprinting technologies were identified, laying the foundation for all other bioprinting technologies. The fundamental limitations, novel approaches, and understandings were compiled. Also, the limitations across the entire bioprinting discipline were separately identified and compiled. Different approaches to solving the existing limitations were scrutinized and possible research avenues and directions were proposed. This understanding of limitations and the proposals may direct young scientists and biomedical engineers to solve them.

Keywords: *biomedical engineering, bioprinting, technological limitations*