

Scaling Up 3D Bioprinting Toward Whole Organ Engineering

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Heart failure is a major cause of death in the United States and sourcing donor organs that are suitable for transplantation remains a longstanding challenge. De novo human organs on demand offer a tantalizing future without donor organ shortages or the need for lifelong immunosuppression. Despite this enormous potential, tissue engineering has struggled to reproduce human scale solid organs with the requisite cell number, cellular density, micro- and macroarchitecture, and vasculature necessary to reproduce physiological function. In this talk, I will highlight recent advances in bioprinting that are unlocking the third dimension of tissue engineering, enabling tissues that are thick, viable, and replete with vascular networks. Finally, I will describe our efforts towards scaling up cell and organoid production in automated liter-scale bioreactors and their rheological behavior when these organoids are compacted into a printable paste. Now leveraging an award from ARPA-H, our large-scale cell manufacturing, bioprinting, and tissue vascularization efforts are converging to form a pathway towards the production of a whole human heart.