

The technology enabled by combining 3D printing ECM-based scaffolds with printed capsules containing molecules and proteins from previous research provides a potential avenue to spatially control the differentiation of stem cells into multiple cardiac cells. To date, we have developed an approach to estimate the concentration of payload in the 4D printed capsules for differentiation. The release of 4D printed capsules has been improved by using multiphoton excitation with higher accuracy and viability. The spatial control of cardiomyocyte differentiation with millimeter-scale resolution in 2D using our printed capsules has been achieved. These results pave the way for 3D printed cardiac tissue. The next step is to achieve a spatial control of cardiomyocyte differentiation in a 3D structure and achieve spatially controlled differentiation of human induced pluripotent stem cells into multiple cardiac lineages to engineer cardiac tissue for therapeutic repair.