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Numerical Simulation and Scaling Analysis of Cell Printing RUI QIAO, PING HE, Clemson University — Cell printing, i.e., printing three dimensional (3D) structures of cells held in a tissue matrix, is gaining significant attention in the biomedical community. The key idea is to use inkjet printer or similar devices to print cells into 3D patterns with a resolution comparable to the size of mammalian cells. Achieving such a resolution in vitro can lead to breakthroughs in areas such as organ transplantation. Although the feasibility of cell printing has been demonstrated recently, the printing resolution and cell viability remain to be improved. Here we investigate a unit operation in cell printing, namely, the impact of a cell-laden droplet into a pool of highly viscous liquids. The droplet and cell dynamics are quantified using both direct numerical simulation and scaling analysis. These studies indicate that although cell experienced significant stress during droplet impact, the duration of such stress is very short, which helps explain why many cells can survive the cell printing process. These studies also revealed that cell membrane can be temporarily ruptured during cell printing, which is supported by indirect experimental evidence.

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