Facile Functionalization and Assembly of Live Cells with Microcontact Printed Polymeric Biomaterials

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Live cells are commonly functionalized with biomaterials for various biomedical applications such as drug delivery, in vivo cell tracking, sensing and immunological modulation. On the other hand, assembling live cells into functional constructs is central to tissue engineering and biomaterials are frequently employed to assist the assembly. Among various biomaterials used to functionalize and assemble live cells, microfabricated biomaterials, which are characterized by precisely controllable dimensions, shape, structure and composition, attract widespread interests. We here reports development of a novel and facile method for functionalizing and assembling live cells with microfabricated biomaterials by integrating microcontact printing of polyelectrolyte multilayers and poly(lactic-co-glycolic acid) with spin coating of poly(N-isopropylacrylamide) for preparing a temperature-sensitive sacrificial layer. It allows immobilizing cells or cell aggregates on the printed biomaterials at 37 °C and releasing the cell-biomaterial complexes at the room temperature.(Figure 1) The printed biomaterial can be made with any two-dimensional shapes ranging from micrometer to millimeter in size and with biodegradable and biocompatible polymers. Three types of cells including a human cancer cell line, mouse embryonic stem cells and human mesenchymal stem cells in the forms of single cells and aggregates have been functionalized and assembled using this method. In addition, this method is facile and inexpensive compared to the conventional methods. It thus holds potential for various applications including drug delivery, cell tracking and tissue engineering.

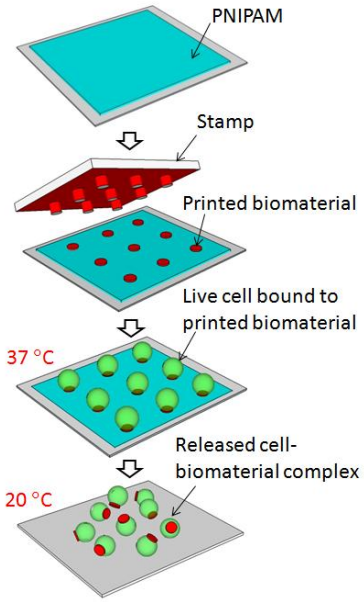


Figure 1. Procedure of functionalizing or assembling live cells with microcontact printed biomaterials using spin-coated PNIPAM as the sacrificial layer. Microparticles and single cells are used here as a model system.