Microfluidic Systems to Fabricate Cellular Multilayers using Layer-by-layer Method

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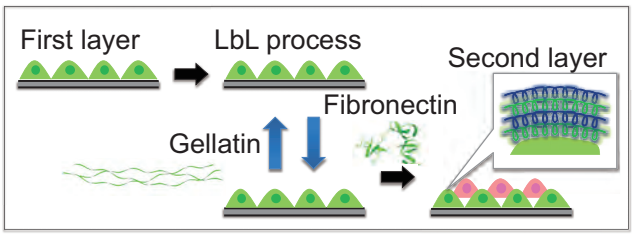
Layer-by-layer (LbL) films of the extracellular matrix (ECM) over cultured cells

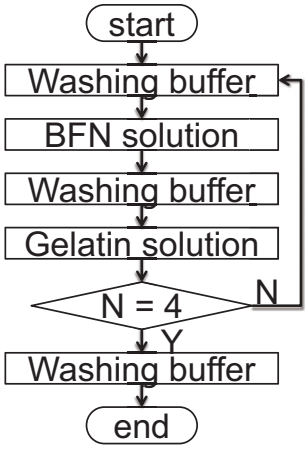


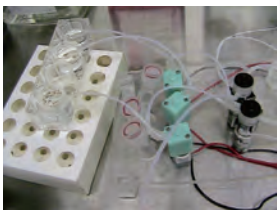
e.g. 2007 Kadowaki et al.

Developed microfluidic systems comprising microfluidic channels and electrical devices for fabricating an LbL film of ECM and a cellular bilayer

The centrifugation process is laborious for LbL in that it requires centrifugation to be performed at least eight times, and it potentially induces negative effects by causing some cells to grow along the hands of the centrifugal force and to form cellular pellets To solve these problems, we have developed an LbL coating process by using a programmed microfluidic system.

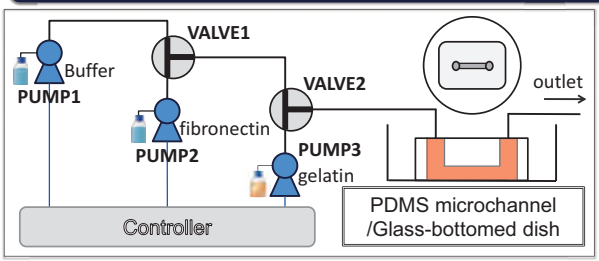
Delivery program for LbL of ECM

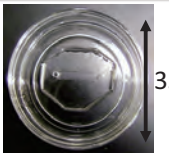




The flow of the washing buffer to the microfluidic channel was regulated using an electric controller

Pumps and valves used to fabricate a layer-by-layer film in a microfluidic channel

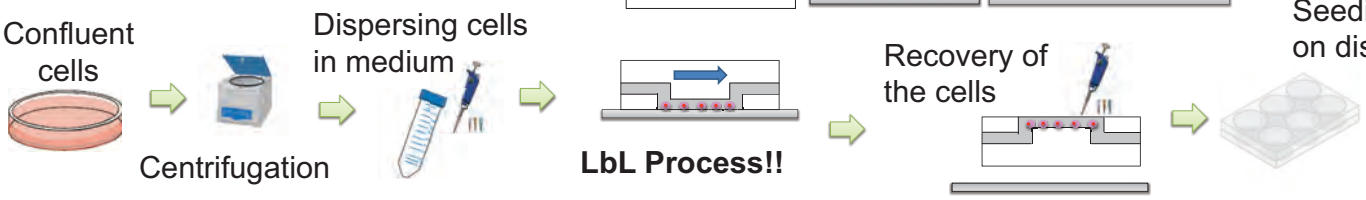




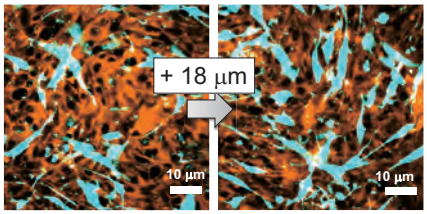
Dimensions of the microfluidic channel for cell coating with ECM

We designed the PDMS-based microfluidic channel for the LbL method in the channel, and formed an inlet center region that was parallel to the flow direction from the inlet to the outlet

Schematic view of experimental protocol for preparation of an LbL film of ECM



Multicolor confocal laser fluorescent microscope images of fixed C2C12 cells



Light blue and brown fluorescence emissions by cells stained by CellTracker Blue and Rhod-2, respectively.)

Reduction of labour costs in fabricating a three-dimensional cellular structures

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Application for evaluation of the experimental models such as drug permeabilization to skin and tissue

Future Perspectives

1 : Model system of mouse implantation in uterus

2 : Alternative animal models for biosafety investigation of innovative materials and pharmaceuticals

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