Electronic Supplementary Material (ESI) for Lab on a Chip.

Supplementary Information for

Microstructure guided multi-scale liquid patterning on open surface

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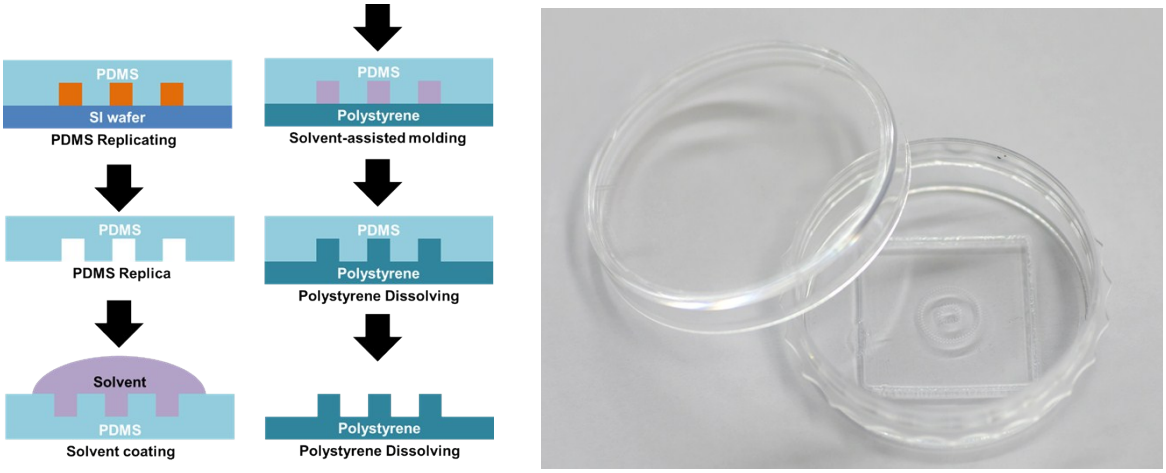

Fig. S1. Schematic diagram of solvent assisted molding and a molded petri-dish which enables multiple patterning. Micropillars are molded with concentric doughnut-shapes on a conventional petri-dish (35 mm). *In vitro* blood vessel vasculogenesis was demonstrated with this device.

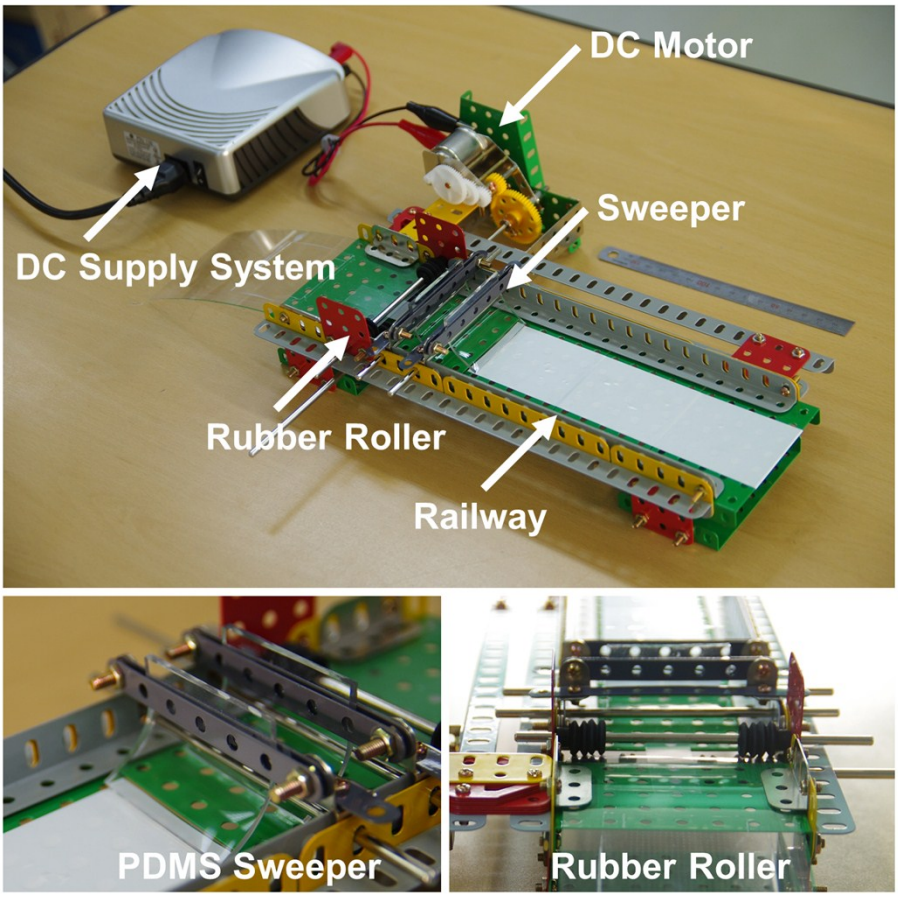

Fig. S2. A prototype of automatic sweeping system. The rubber roller transports a micropatterned PS film under a fixed PDMS sweeper. This system provides stable sweeping speed and uniform contact between the sweeper and the film.

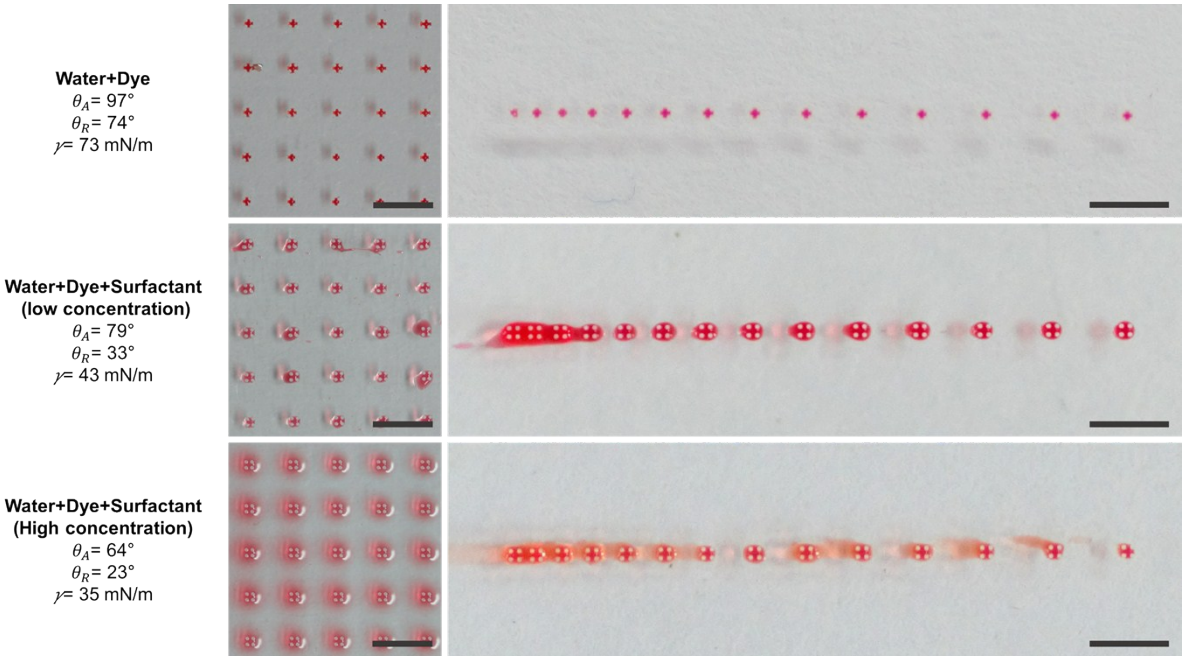

Fig. S3. Result of droplet patterning with liquids having various contact angles on PS surfaces and surface tension coefficient. The droplets deform to lower surface energy after retention. In the right figures, the patterning spots are arrayed with spacing ranging from 300 μm to 1500 μm. Closely patterned droplets merged when the liquid has low contact angle and surface tension coefficient. Triton X 100 was added to dyed water as surfactant with volume ratio of 0.008% and 0.02% for low and high concentration condition, respectively. The height of pillars is 100 μm and scale bar is 2 mm.

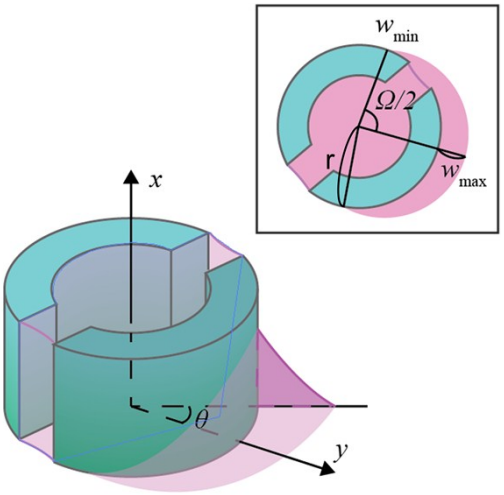

Fig. 4S. Schematic diagram of liquid patterned in facing C-shaped pillar array. Parameters used for approximation of volume of liquid are described.

Estimation of volumes of patterned liquids

Circular pillar array

The volume of trapped liquid between the circular pillar array was estimated by taking a top view image and multiplying the area of the visible liquids by the height. The height of the trapped liquid is assumed to be same as the height of pillars. The area of visible liquids was measured from imageJ (NIH).

Facing C-shaped pillars

The volume of patterned liquid between the facing C shaped pillars was divided into two parts; the volume, V_{in}, confined by the pillars and the volume, V_{out}, remaining outside the pillars. The former was estimated by multiplying the inner area of microstructures by the height of pillars and the latter was calculated by the integration in cylindrical coordination. (Fig. 4S)

$$dV_{out} = \frac{1}{2}(y^2 - r^2)d\theta dx$$

$$V_{out} = \frac{1}{2}\int_0^{2\pi}\left(\frac{1}{3}w^3 + w^2 r\right)d\theta$$

Here, we assumed that the cross sectional shape of the outer liquid column is an isosceles triangle. w is the width of liquid column at a certain θ and r is outer radius of the pillar arrays. We further assumed that w varies linearly from w_{min} to w_{max} between the range of $\Omega/2$, the half angle of the outer liquid column. We measured w_{min}, w_{max}, and Ω using imageJ (NIH).

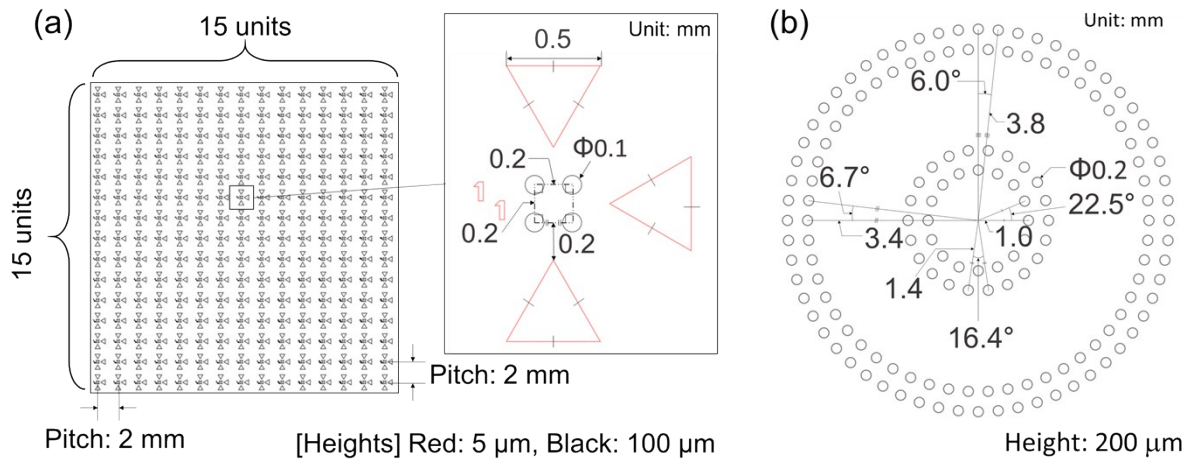

Fig. S5. Drawings of platforms used for cell-based applications. (a) Single cell analysis platform. 15 x 15 units of patterning areas are arrayed within a substrate of 30 x 30 mm. Coordinates and indicators are molded with heights of 5 μm not to guide the swept liquid. (b) Co-culture platform applied for *in vitro* blood vessel formation. Circular pillars with diameters of 200 μm are arrayed in doughnut-shapes.