A Biomimetic Cell Culture Platform for Microfluidic Cell-based Assays

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Abstract

Biomimetics is actively applied in cell culture systems including a bioreactor for keeping full functionality of in vivo organs.\(^1\) Recently, several trials to mimic an in vivo environment are demonstrated by combination of microfluidics and 3-dimensional cultivation in polymer-synthesized scaffolds or natural hydrogels.\(^2\) Although these schemes are highly advanced as a cell culture system, they are not suitable for various cell-based assays. In this paper, we first describe a microfluidic cell culture platform by use of peptide hydrogel to better imitate the in vivo. The microchannel is fabricated by poly(dimethylsiloxane) replica molding. Mixture of the peptide hydrogel and human hepatocellular carcinoma cell (HepG2) is hydraulically focused by both sides of de-ionized water and media flow. Since the peptide hydrogel contacting the media self-assembles into a 3-dimensional transparent hydrogel, the HepG2 cells are immobilized in stripe shaped 3-dimensional microenvironment at the center of the main channel in a microfluidic device. By use of this biomimetic culture platform, the microfluidic device could be useful for reliable cell-based assays including 3-dimensional co-culture, cytotoxicity test, continuous monitoring of cell viability, drug screening, and drug-drug interaction study.

References

2. T. Braschler, R. Johann, M. Heule, L. Metref and P. Renaud, Gentle cell trapping and release on a microfluidic chip by in situ alginate hydrogel formation (2005), Lab Chip, 5(5), 553-559.